Railway Mechanical Engineer

Volume 96 | December, 1922 | No. 12

The Importance of Knowing Shop Costs

One serious weakness of most railroad shop organizations is the lack of an accurate system for rapidly computing detailed shop costs. Shop costs are fundamental to a manufacturer and absolutely limit the minimum selling price under which he can continue to do business. Costs are also fundamental to a railroad mechanical department which, however, is not compelled to go out of business when the costs become excessive. In this case the loss is simply transmitted to the stockholders, affects railroad credit adversely, and therefore is harmful to everyone connected with the railroad industry, if not the country at large. Shop costs must be both accurately and promptly known. It is of no avail to discover the costliness of a certain operation several months after it has been carried to completion. In fact, whenever a new method or practice is to be installed, the effort should be made to predict in advance what the cost will be, thereby avoiding those practices which are uneconomical.

It is only by the use of some reliable cost system that shop operations can be controlled with any degree of efficiency and economy, pointing out those practices which are expensive and enabling them to be corrected. Simplicity must also be a feature of any cost system successfully applied in railroad shops. It is recognized that in this case costs cannot be figured with the same detail as in a manufacturing plant where repetition work is carried on, but the essential costs can, and should, be known. The fact that many details are eliminated will reduce the clerical force required to operate the cost system and enable estimates to be made more promptly. That railroads are becoming more deeply appreciative of the need for simple, reliable cost systems is indicated by the fact that an eastern road at the present time is installing a new cost accounting system in accordance with the best modern thought. The experience of this road in installing the new system will be followed with interest by railroad men in general.

Reasons for Three-Cylinder Locomotives

Attention already has been called to the increasing number of three-cylinder locomotives which are being placed in service on European railroads. Several locomotives of this type were chosen as examples of recent British designs for the article which appears in this issue, and additional examples have been selected for the next installment. The Spanish locomotive described in the August issue is reported to have proved so satisfactory in service that 17 more have been ordered. Three-cylinder locomotives are also making excellent records in France, while the German State Railway has adopted this cylinder arrangement for the latest standard types of 4-6-0, 2-8-2 and 2-10-0 passenger and freight locomotives.

Some of the characteristics which have caused the adoption of this type were well brought out in an article in the November issue. The fact that the three-cylinder locomotive is capable of attaining some 15 per cent more hauling power for the same adhesive weight than the two-cylinder locomotive is a matter of prime importance, because the economic efficiency of a locomotive depends to a considerable extent upon the total weight per unit of power. The lighter reciprocating parts with a corresponding decrease in dynamic augment, together with the more uniform torque, result in smoother running and less stress upon track and bridges. In starting power and in rapidity of acceleration, three-cylinder locomotives also are superior, while the draft on the fire from six instead of four exhausts per revolution is more uniform and tends to better economy in combustion.

The results which are obtained from three-cylinder locomotives as their number is increased and as additional data in regard to operating and maintenance costs have been accumulated, will be watched with great interest. However, the adaptability of the type for American railroad conditions can be determined only by experience and tests on American lines.

Draft Gear in Theory and Practice

From a theoretical standpoint, it is easy to demonstrate that the desirable characteristics for a draft gear are high final resistance, building up gradually from a low initial value, long travel and slight recoil. It is also easy to show that these characteristics can be obtained only in a friction gear. An analysis of gears from the standpoint of capacity or work absorbed indicates that the ordinary draft springs would be so far inferior to the average friction gear that the use of the two types in the same service would seem almost out of the question. Two class *G* springs would go solid from the impact of a 40-ton car at two miles per hour, while an efficient friction gear would absorb five times as much energy and would not go solid until a speed of about 4½ miles an hour was reached. There are still many cars in service equipped with spring gears and in practice the capacity of springs does not seem to be so greatly inferior to that of friction gears as these figures would indicate. The fact that spring gears prove satisfactory at speeds of impact considerably in excess of their theoretical rating and that friction gears sometimes do not protect the car at moderately low speed indicates that there is further need for investigation of the action of draft gear under service conditions.

There are probably a number of reasons which account for the difference between theory and practice in draft gear action. The yielding of the car members is no doubt an important factor in relieving the high stresses that would be set up by solid impact. An advantage of the spring gear, which often is not considered, lies in the fact that there is always a considerable force acting to return it to the normal position. It is not improbable that in attempting to eliminate recoil the return force in many friction gears has been reduced too much to afford satisfactory action in trains. A great many friction draft gears after they have been compressed require only 10,000 lb. to 30,000 lb. to keep them in the closed position and, when in this position, they have

very low capacity. If the gear is not in first-class condition, even less pressure may be sufficient to hold it closed. It is evident that a draft gear may be closed by shock while it is in a train behind a locomotive with a high tractive force, and if under this condition another shock is imposed on the gear, it is practically equivalent to a solid impact. Observation of cars in the head ends of trains will show that the coupler is often drawn out a considerable distance beyond its normal position, indicating either that there is free slack in the draft gear, or that it creeps toward the closed position under the varying drawbar pull exerted by the locomotive.

If parts of friction draft gear wear the resistance may be reduced very greatly, or if the surface is cut the resistance may increase and the force of release may not be sufficient to overcome the internal resistance and bring the gear back to the open position. Friction draft gears are very sturdy devices, but it is too much to expect that they will continue to protect the car properly, without attention under the severe stresses imposed upon them. There is no question but what periodical inspection and repair would eliminate many of the troubles that are now experienced and such work, if properly organized, should save considerably more than it would cost. The draft gear problem has probably been approached too much from the theoretical standpoint. If practical car men would give designers the benefit of their experience, it would be helpful in determining the type of equipment that is most satisfactory under average service conditions.

Analyzing Test Results

No one who has studied carefully the results of numerous tests of materials and appliances made by the railroads can fail to be impressed by the inconclusive results upon which large purchases are often based. To conduct tests that will determine accurately the relative performance to be expected from different products requires that the conditions which might influence the results shall be uniform, that the observations be made with such accuracy that the effect of possible errors will be negligible, and that all factors involved shall be given proper consideration.

These facts may seem self-evident, but nevertheless they are frequently overlooked. For example, a railroad conducted a test of two devices which indicated that one gave an economy of 25 per cent in coal per car mile and per pound of water evaporated over the other. An analysis of the conditions, however, showed that the results of the test could not possibly be accurate. One device was tested while the average temperature was 67 deg. and the other in much colder weather with an average temperature of 24 deg. During two of the cold weather trips the boiler was leaking, which would, of course, have an adverse effect on the evaporation. The temperature of the feedwater on some trips was estimated. The character of the coal varied from good lumps to 90 per cent slack. Yet the heating value of the various grades of coal was not ascertained. It is beyond the power of any engineer to make proper corrections for the many variable factors that would have influenced the results of this test, and it certainly cannot be accepted as a true measure of the relative economy of the two appliances.

In another case, a device which is designed to improve combustion was applied to a locomotive and as a result of tests conducted with and without the appliance, an economy of 10 per cent in fuel was claimed. This was based on the coal consumption per horsepower hour, which would be effected by the efficiency of the cylinders and valves as well as by the boiler efficiency. The boiler efficiency, which would give a far better indication of the relative performance, was practically the same in both cases.

Many tests to determine coal consumption are conducted by counting the number of scoops of coal fired, on the assumption that the weight of coal with a given size of scoop is always practically the same. The fallacy of this idea is clearly shown by a series of tests in which the coal was carefully weighed and the number of scoops used also counted. The same man fired the locomotive in all the tests and he used the same size scoop, but the weight per scoop varied from 13.8 lb. to 16.3 lb.; thus any results based on the number of scoops would have been subject to an error of 18 per cent and might have resulted in the endorsement of a worthless device, or the condemnation of a meritorious device.

Carefully conducted tests are invaluable to the railroads, enabling them to operate in the most efficient and economical manner. The slight expense required to get accurate results is usually negligible by comparison with the sums which railroads may save or lose as a result of the tests. In this work, more than in any other, exact knowledge is indispensable.

Second-Hand Machine Tools

The fact has been emphasized in these columns before that second-hand machine tools should be purchased by the railroads only with the greatest caution. Unquestionably, used machinery which has been in service only a short time and received proper care and attention during that period can sometimes be purchased at a material reduction in cost and be practically as good as new. The railroads are badly in need of large amounts of new machinery for which in many cases appropriations are not available. No one will quarrel with the roads if, by purchasing machines which are practically new at a reduced price, they are enabled to fill a larger proportion of their needs. As a rule, however, the results of buying second-hand machine tools are uncertain and frequently unsatisfactory. In a specific case a large railroad in the middle west ordered two turret lathes of a manufacturer and cancelled the order when it heard of two second-hand machines of the same type in the hands of a machinery dealer. The manufacturer was naturally anxious to keep the order and, checking up the serial numbers, found that these two turret lathes had been working three eight-hour shifts in a Canadian shell plant since 1914 and were in extremely bad shape. By explaining the situation in detail, the railroad was induced to cancel its order for the second-hand machines and reinstate the order for new ones. The point is that second-hand machinery should be purchased only when it is in good condition, which is sometimes difficult to decide even by the most competent inspectors. Particular care should be observed in buying machines which may have been used on repetition work with the consequent undue wear of certain parts which may not be evident on inspection. An important query is put by this turret lathe manufacturer as follows: "If the average large industrial manufacturer does not feel it safe or a good investment to buy second-hand machinery unless he knows all about it, how can the railroads afford to save money in that way when most of their present equipment is hopelessly out-of-date?"

Stop Leaks or Maintain Air Compressors?

The air compressor has well been called the heart of the air brake system, for the ability of the air brake to perform its functions depends entirely upon its continued operations. Air compressor maintenance is consequently an important matter both in the roundhouse and in the back shop. Changing conditions have steadily increased the legitimate demands for air and while the capacity of the compressor has been correspondingly increased, and at the present time many of the heavier

locomotives are equipped with two compressors of the largest size, with some freight trains their combined capacity is none too great. The air brake system, moreover, is not the only source of demand upon the compressor. Locomotive auxiliary devices, such as reverse gears, bell ringers, fire doors, coal pushers, sanders, water scoops and cylinder cocks, are now most conveniently operated by compressed air and unless maintained in good condition they require much more air than is commonly supposed. The greatest drain upon the compressor, however, is the need of maintaining the required pressure in the air brake system in the face of many leaks. Even though none of these may be large the combined drain may be sufficient to render the proper control of the train difficult while the additional work which their presence throws upon the air compressor soon brings about such a degree of wear that an overhauling with reboring of cylinders and renewals of piston rings, valves and other parts is rendered necessary. It is not infrequent to find a long freight train on which the leakage and consequent waste of air is as much as would be required to fully apply the brakes every few minutes.

During recent months many roads have not been able to maintain their locomotive air compressors in the condition which experience has shown to be advisable for satisfactory train operation and have done even less than usual in the direction of correcting leakage in the piping of freight car brakes. The air brake situation is serious for upon its performance the ability of the railroads to handle the large amount of traffic now being offered depends to a considerable extent. Some definite maintenance policy must be decided upon. To allow matters to drift will necessitate a reduction in the length of freight trains to that for which the compressor or compressors with which the locomotives are equipped can supply the air to maintain the leaks and yet leave a sufficient margin to release and recharge the brake system in a reasonable time. To depend upon air compressor maintenance to meet the situation will mean running compressors at high speed, rapid wear with frequent renewals and expensive repairs by mechanics none too easily secured, not to mention the large bills for coal consumed unnecessarily. The only proper way and the one which will have to be adopted eventually is to employ additional men at terminal yards to tighten up pipes and joints and so reduce the excessive air waste which is now to be found in so many parts of the country.

New Books

THE WELDING ENCYCLOPAEDIA—*Edited by L. B. Mackensie and H. S. Card, 388 pages, 550 illustrations 6 in. by 9 in., bound in flexible imitation leather. Published by The Welding Engineer Publishing Co., 608 Dearborn St., Chicago, Ill.*

A reference book on the theory, practice and application of the four autogenous welding processes. The first half of the book consists of a dictionary of all words, terms and trade names used in the welding industry. Included in this portion are instructions for welding operations on the most common types of repair work and their application to the various industries. Oxyacetylene welding, electric arc welding, electric resistance welding and thermit welding are each treated and general instructions are given for the use of each process with every metal that can be welded by it. Separate chapters are included on the subjects of boiler welding, tank welding, pipe welding and rail joint welding. Another section is devoted to the rules and regulations enforced by federal and state authorities and insurance companies on the construction, installation and operation of welding equipment. A collection of charts and tables is also included. The catalogue section at the end of the book describes and illustrates the standard lines of welding equipment and apparatus.

AIR BRAKE CORNER

Adjustment of E-7 Safety Valve for Type L Triple

Question.—When making a test to determine the action of an E-7 safety valve which is used with type L triple valves, I have noticed that after the regulating nut had been adjusted to give the desired opening pressure of 62 lb., a second test made after the cap nut had been replaced did not give the same result. It is not uncommon to find that the opening pressure after the cap has been screwed on is several pounds higher than it was when the cap was removed. In order to secure the proper setting, it is necessary to first adjust the pop at a lower pressure than desired. Can you explain the reason for this action?—A. D. P.

Answer.—When the regulating nut of the E-7 safety valve has been tightened down so that the valve opens at the desired pressure, a certain spring tension has been set up. When the cap nut is screwed on it may cause the regulating nut to turn slightly and thus increase the spring tension. The extent of such movement will depend upon the fit of the threads on the adjusting screw and in the cap nut, the presence of rust or dirt tending to increase the change in adjustment. With a proper easy fit no change in adjustment should occur. If it is found necessary to allow something for putting on the cap nut, it is evident that the fit of the cap nut threads is too tight.

What Our Readers Think

A or B End of Car

CHICAGO, ILL.

TO THE EDITOR:

Referring to the question by F. J. B. in the August number of the *Railway Mechanical Engineer* relating to designation of *A* or *B* end of cars in accordance with A. R. A. Rule 14.

It is the writer's opinion that Rule 14 as now written is misleading and does not cover the various forms of brake equipment now in use and that therefore this rule should be re-written along the following lines:

The end of car toward which the cylinder push rod travels shall be known as *B* end and the opposite end shall be known as *A* end on all cars with only one brake equipment and only one hand brake, except that on such cars on which the push rod travels downward or upward in a vertical direction or on cars on which the cylinder push rod travels at right angle with the longitudinal sills or on cars where the cylinder is underneath the hoppers on end of car with the push rod traveling in an opposite direction to the pull of the hand brake rod and chain. On such cars the end on which the pressure retaining valve and the brake mast is located shall be known as the *B* end, it being understood that the pressure retaining valve be always located on the brake mast end of car.

On cars equipped with two hand brakes and two brake cylinders, the push rods of which are traveling in opposite directions, the end where the two pressure retaining valves are located shall be known as *B* end.

CAR INSPECTOR.

Influence of Manganese in Carbon-Vanadium Steel

CHICAGO, Ill.

TO THE EDITOR:

In the description of the Union Pacific Mountain type locomotive published in the July issue of the *Raiwlay Mechanical Engineer,* special mention was made of the annealed carbon-vanadium steel used in rods, axles and crankpins. The saving in weight due to this material was discussed also in an article by R. J. Finch in the October number.

Both of these articles would give the impression that the improved properties of the carbon-vanadium steel were due entirely to the presence of vanadium. On looking into the matter, however, it is evident that there are other differences in chemical composition which might account for a large part of the improvement in the properties of the steel. The specifications of the Mechanical Division of the A.R.A. for axles, shafts and other forgings require that the carbon shall be between 0.38 and 0.52 per cent and the manganese between 0.40 and 0.70 per cent. Carbon-vanadium forging steel, on the other hand, has a carbon content between 0.45 and 0.55 per cent and manganese between 0.70 and 0.95 per cent. Since the higher percentage of carbon and manganese would both tend to increase the ultimate strength and elastic limit of the steel, I should like to know what difference there would be between a carbon-vanadium forging steel and a steel without vanadium having the same proportion of carbon and manganese? DESIGNER.

The above letter was referred to the Vanadium Corporation of America, from whom the following reply has been received.

NEW YORK, N. Y.

TO THE EDITOR:

Referring to your letter enclosing a communication from "Designer" requesting information as to the influence of manganese in carbon-vanadium steel. Your correspondent calls attention to the higher percentage of manganese specified for carbon-vanadium steel locomotive forgings than in the case of the A.R.A. specification, and queries whether this higher percentage of manganese rather than the vanadium is not largely the cause of the increased physical properties.

The difference he calls attention to in the carbon percentage range between the A.R.A. specifications and the carbon-vanadium steel specifications is more apparent than real. While the A.R.A. specifies 0.38 per cent to 0.52 per cent carbon it is unusual to find forgings containing under 0.40 per cent and the bulk of the forgings will be within the range of 0.45 per cent to 0.55 per cent specified for carbon-vanadium steel. The actual difference in the carbon specified only amounts to 0.03 per cent or the difference between 0.52 per cent and 0.55 per cent the upper limits specified. This disposes of the supposition that the increased physical properties of the carbon-vanadium steel are partly due to the higher carbon percentage.

The accompanying tabulated tests from normalized (reheated and air cooled) locomotive forgings show clearly the influence of vanadium in increasing the physical properties of steel of the same chemical composition. The carbon-vanadium steels given are all within the A.R.A. specification limits for carbon and manganese. All these forgings, both the plain carbon and the carbon-vanadium, were given a standard normalizing treatment, the temperatures being practically the same. It will be noted that there are only slight differences in carbon and manganese percentages; in some instances these are higher in the case of the plain carbon steels.

Furthermore, it will be noted that these tests demonstrate also that it is possible to meet the high tensile properties specified for carbon-vanadium steel with manganese within the limits specified by the A.R.A., viz. 0.40 to 0.70 per cent.

Additional evidence illustrating the effect of vanadium in increasing the physical properties of steel is shown in the second table, giving tests from rails of essentially the same composition with and without vanadium. These tests were all cut from the same position in the head of the rail; the rails were of the same section and weight, and rolled at the same mill. The tests were made from the rails as rolled.

From a comparison of the above tests from normalized plain carbon and carbon-vanadium forgings of practically identical manganese and carbon percentages, it is apparent that the higher physical qualities of carbon-vanadium steel are due to the presence of vanadium, and not to any difference in carbon or manganese percentages.

GEO. L. NORRIS,
Vanadium Corporation of America.

TABLE I.—COMPARATIVE TESTS OF LOCOMOTIVE FORGINGS.

TO ILLUSTRATE THE EFFECT OF VANADIUM ON STEEL OF OTHERWISE SIMILAR CHEMICAL COMPOSITION.

All tests given are from normalized (reheated and air cooled) forgings.

Chemical Analysis						Physical Tests				Forging
C.	Mn.	P.	S.	Si.	V.	E. L.	T. S.	Elong.	R. A.	
.48	.64	.010	.041	....	...	48,200	89,660	23.5	37.8	Piston rods.
.48	.64	.010	.041	....	...	51,960	92,420	24.5	43.4	Piston rods.
.48	.64	.010	.041	....	...	45,230	87,920	24.0	40.3	Piston rods.
.50	.62	.014	.036	....	...	49,220	89,900	23.0	36.6	Pins.
.54	.69	.012	.024	....	...	42,210	81,430	26.0	40.4	Rod straps.
.51	.63	.018	.032	....	...	44,250	90,020	23.5	37.0	Main rods.
.48	.69	.016	.032	....	...	46,960	90,170	21.5	37.5	Main pins.
.51	.63	.018	.032	....	...	49,450	90,150	23.0	43.9	Front rods.
.48	.60	.015	.035	....	...	47,450	91,400	20.0	32.5	Main rods.
.48	.60	.015	.035	....	...	51,450	97,660	20.0	34.7	Main rods.
.59	.52	.014	.029	....	...	44,110	88,420	24.0	37.9	Main pins.
.45	.48	.014	.036	....	...	41,460	83,920	25.5	42.8	Int. rods.
.51	.61	.035	.037	.180	...	49,220	81,700	26.0	46.9	Piston rods.
.48	.40	.017	.045	....	..	42,250	85,500	21.5	35.7	Cross head pins.
.52	.52	.025	.025	.210	...	47,000	82,290	24.5	41.9	Main pins.
.44	.61	.026	.028	....	.19	63,940	92,400	22.0	40.4	Main rods.
.44	.61	.026	.028	....	.19	61,440	95,280	23.5	41.8	Trailer axles.
.44	.61	.026	.028	....	.19	60,140	94.500	23.0	49.2	Main pins.
.44	.61	.026	.028	....	.19	61,690	96,900	21.0	40.4	Driving axles.
.44	.61	.026	.028	....	.19	63,940	92,400	22.0	40.4	Main rods.
.48	.68	.019	.024	.162	.15	64,520	100,000	24.5	47.7	9-in. rounds.
.48	.68	.019	.024	.162	.15	66,500	100,000	22.5	41.0	9-in. rounds.
.50	.57	.027	.023	....	.16	63,940	101,900	24.0	43.1	Rod straps.
.42	.65	....	....	....	.18	62,700	92,800	24.5	57.0	20⅜-in. dia. gear shafts.
.42	.65	....	....	....	.18	67,100	97,000	26.0	59.0	13-in. propeller shafts.
.55	.75	.018	.025	....	.21	60,700	101,900	22.5	42.8	10-in. snow plow shaft.

TABLE II.—TESTS FROM RAILS

.74	.68	.011	.035	....	...	60,000	123,000	10.5	14.5
.72	.67	.035	.028	....	...	63,000	112,500	13.5	20.5
.68	.78	.018	.038	....	.24	95,000	143,000	10.0	17.0
.73	.76	.020	.030	....	.19	90,000	140,000	10.0	14.0
.56	.78	.017	.025	....	.16	80,000	118,000	13.0	22.0

Elastic limit and tensile strength are given in pounds per square inch. Elongation and reduction in area in per cent.

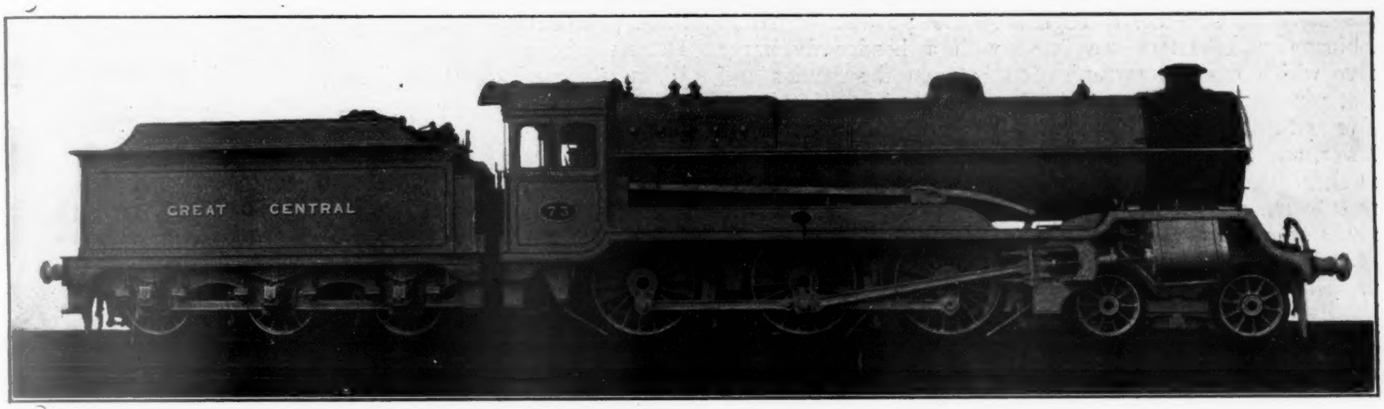


Fig. 1. Great Central, Four-Cylinder, 4-6-0 Type Fast Freight Locomotive

Recent Tendencies in British Locomotive Practice

PART 1

Description of Important Designs; Piston Valve with Relief and By-pass Features; Mechanical Lubricator

By E. C. Poultney

IN the present article the writer proposes to illustrate and describe some typical recent locomotives built for service on British railways which indicate the tendencies of modern practice.

Perhaps one of the most striking features is the large use made of either three or four cylinders, and of these the three cylinder arrangement seems to be rapidly gaining favor. On the North Eastern three-cylinder 4-4-2 type express locomotives have been in service since about 1910, and the same cylinder arrangement has more recently been extended to 4-6-0 and to mineral traffic locomotives of the 0-8-0 type on this railway. The Great Northern has also adopted three cylinders for both 2-6-0 and 2-8-0 type freight locomotives, and quite recently for some Pacific type express locomotives which are just out of the Doncaster shops. The Caledonian has also recently completed a new design of very powerful three-cylinder 4-6-0 type express locomotives.

The London & North Western, Great Central, and Great Western each has a considerable number of 4-6-0 type four-cylinder locomotives in service for express passenger traffic, and the second named line has a number recently built primarily for fast freight trains. About two years ago some powerful 0-10-0 type engines having four cylinders were built at the Derby shops of the Midland railway, designed for helper service on the Lickey incline on the West of England main line between Birmingham and Bath.

It is of course generally well known that the ordinary British type locomotive has two inside cylinders, and there are now and probably always will be large numbers of locomotives having this particular characteristic; nevertheless, there is no doubt that for the higher powers usually necessary to meet modern conditions, the two-cylinder locomotives when used will have their cylinders outside.

Steam pressures have undergone some changes during recent years. Previous to the general introduction of flue tube superheaters, boiler pressures ranged from about 170 to 200 lb. With the advent of superheating, there was a general tendency to reduce pressures to about 160 lb., and increase the cylinder volume. The practice is now towards the higher pressures, and those of 180 to 200 lb. are considered necessary, whilst cylinder volumes are continually increased to furnish the necessary power; in fact, it is largely the greater cylinder capacity now required that has prompted the introduction of three- and four-cylinder locomotives.

Locomotives now built for main line working are practically all fitted with flue tube superheaters, and older engines when requiring extensive repairs and renewals, or to be rebuilt, are as a rule superheated, and when this course is adopted, it is usual to fit new cylinders with piston valves. Whilst the type of superheater used is in all instances the same, there are in some cases considerable differences in details. This applies more especially to the design of the headers.

The Eastleigh, Horwich, and Swindon designs adopted on the London & South Western, Lancashire & Yorkshire (now London & North Western), and Great Western, are cases in point. Other superheating equipment used is either of the pattern designed by Marine & Locomotive Superheaters, Ltd., or the Superheater Corporation, which latter controls the "Robinson" patents.

The feature of the "Robinson" design is in the method of uniting the elements and header, which is effected by expanding the elements into the header in the same manner that the boiler tubes are fixed in the tube sheets. This is a simple method, and seems to give satisfactory results. In a written contribution to the discussion of a paper recently contributed to the proceedings of the Institute of Mechanical Engineers, entitled "British and American Locomotive Design and Practice," J. G. Robinson said that the extraction of the units was quite as easy as expanding them in place, and that there were cases in which the units had been expanded and extracted as many as six times, and were still in service. The mileage per set of units in a 4-6-0 engine was in one instance 378,448 for a life of 9¼ years, and in the case of 2-8-0 mineral engines a mileage of nearly 200,000 for 9½ years was realized.

Damper gear has been discarded now by all railways.

Automatic air valves are quite often fitted to the steam chests and sometimes on the header (wet steam side). The South Eastern, Chatham & Dover, Great Eastern, Great Northern, and Caledonian adopt this arrangement. The North Eastern fits a small valve which is opened to allow a

little steam to circulate through the elements when drifting. Robinson superheaters are fitted with a header discharge valve which opens communication between the header and blast pipe when the throttle is closed, and a special blower valve is fitted which when turned in one direction starts the blower, and simultaneously allows steam to circulate through the elements, and from thence through the discharge valve to the exhaust, and in the other direction steam to the blower only is supplied.

Cylinder by-pass valves are not generally used, neither are pyrometers, the explanation regarding the latter usually given being that difficulty is experienced in obtaining reliable instruments.

Tests Show Value of Superheating

There seems to be some difference of opinion as to the utility of fitting superheaters to locomotives working intermittent services, that is, where there is much starting and stopping, and on some railways where the runs are short and stops frequent saturated steam locomotives are still much employed.

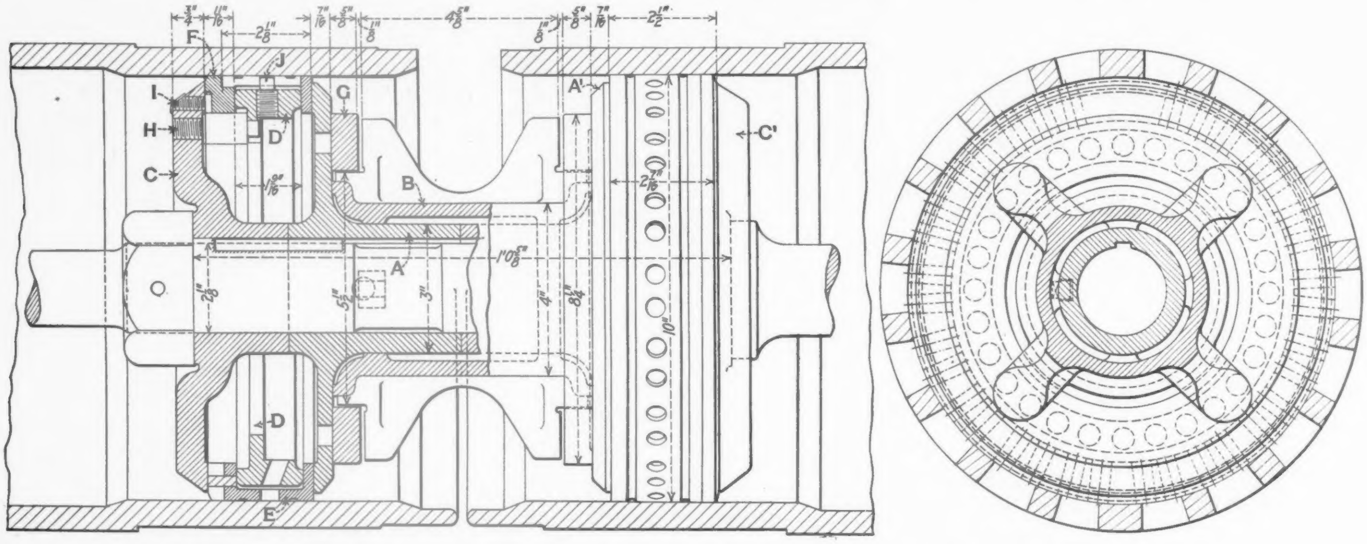


Fig. 2—Robinson Piston and Pressure Relief Valve Used by Great Central

Recently some interesting tests have been carried out on the North Staffordshire, a small line employing for the most part tank engines on what may be called extensive local services. Three 0-6-2 type locomotives were experimented with, each alike in all respects except that one was superheated. The engines each had 18½ in. by 26 in. cylinders. 175 lb. steam pressure, 60 in. drivers and ordinary flat unbalanced valves. The engines were tried against each other on the same sections of road with similar trains on similar services, all water and coal consumptions being carefully recorded and reduced to a ton mile basis for comparison. The overall results may be summarized as follows:

		Saturated steam locomotives	Superheated steam locomotives
Trial 1—	Ton-miles	117,023	113,705
Passenger Service.	Coal per ton-mile.	0.235 lb.	0.237 lb.
	Water per ton-mile	1.557 lb.	1.570 lb.
Trial 2—	Ton-miles	98,243	116,434
Passenger Service.	Coal per ton-mile.	0.270 lb.	0.216 lb.
	Water per ton-mile	1.560 lb.	1.440 lb.
Trial 3—	Ton-miles	135,737	145,623
Freight Service....	Coal per ton-mile.	0.157 lb.	0.135 lb.
	Water per ton-mile	0.968 lb.	0.760 lb.
Trial 4—	Ton-miles	93,608	114,812
Passenger Service.	Coal per ton-mile.	0.250 lb.	0.200 lb.
	Water per ton-mile	1.650 lb.	1.230 lb.

During the last passenger tests the superheated locomotive operated with a steam pressure of 160 lb., and with the blast pipe enlarged from 4⅞ in. to 5⅛ in. diameter. A Detroit lubricator for the valves and pistons, and also a Wakefield mechanical lubricator were tried separately, and both are reported to have given satisfaction. The wear of the valves on the superheated engine was found to be no more than normal. Records of the steam temperatures revealed the fact that when running the temperatures ranged from 550 to 620 deg. F., and that the drop was very rapid on closing the regulator. With stops of four minutes' duration, the header temperature fell to about 60 deg. F. above the normal temperature of the saturated steam. The above particulars are taken from a paper read by J. A. Hookham before the Institution of Locomotive Engineers, London, May 4, 1922.

Robinson Piston and Pressure Relief Valve Used on Great Central

Proceeding now to a delineation of some new locomotives, the first to be dealt with is illustrated by Fig. 1. This is a large four-cylinder engine of which several are now in traffic on the Great Central. The engines, which are of the 4-6-0 type, have been built to the designs of the chief mechanical engineer, J. G. Robinson. In general they are similar and in many of their details interchangeable with a series of 4-6-0 express locomotives introduced previously, and of which several have been built during the last two years. The principal difference is that whereas the engine illustrated has 68 in. wheels, those of the passenger engines have 81 in. drivers. The class represented by Fig. 1 have been built to handle heavy fast freight trains. The four cylinders are 16 in. by 26 in. and are in line across the engine, two in one casting between the frames and under the smoke box driving the crank axle of the leading coupled wheels, and the outside cylinders connected to the second pair of wheels. Two sets of link motion, the eccentrics for which are mounted on the crank axle, work four piston valves, one for each cylinder. Those for the inside cylinders have inside admission and those for the outside have outside admission. The adjacent cranks on each side of the engine are at 180 deg. to each other, so that with valves arranged as described each pair on each side can be operated by one set of valve gear by two upper parallel arms of a three-armed rocker, the lower arm being connected to the valve gear, and those above to each valve spindle.

The piston valves are of the type shown by Fig. 2, which has been made from a drawing furnished by J. G. Robinson. The valves are known as Robinson's patent combined

piston and pressure relief valves, and have been designed to fulfill the following functions:

(a) To prevent sudden reversal of stresses in the motion when the engine is running without steam.

(b) To release any undue pressure from the cylinders when that pressure is higher than that in the steam chest.

(c) To provide for the circulation of air from one side of the pistons to the other, and thus prevent the influx of gases from the smoke box through the blast pipe when running with steam shut off.

The drawing is of a valve arranged for inside admission. The main part of the valve is formed in four sections which may be made of cast iron or mild steel. These pieces are slipped over the spindle on which they are prevented from turning by keys. The main packing rings *E* of L section are of cast iron, and have round their periphery a number of 7/16 in. holes, the object of which is to allow communication between the steam ports and the valve body. A number of ½ in. holes are drilled in the inner sections *D* of the valve, their position being clearly shown in the sectional and end views.

Sliding on a cast iron guide *B* threaded over the center portion of the main valve body are two high carbon steel rings *G* which, when the throttle is open and steam pressure in the chests, are held to a seating over the ½ in. holes.

If at any time the pressure in the cylinders should rise higher than that in the steam chest, due to excessive compression or any other cause, the rings are forced from their seatings and the pressure relieved through the holes in the packing rings before mentioned, and via the ring valves into the steam chest. Further, when the engine is running with steam shut off the ring valves easily may leave their seatings and the piston valve then will act as a cylinder by-pass valve, thus functioning as mentioned in paragraph (c). Stops are provided on the valve guides by which they are limited to ⅛ in. lift. Originally, the ring valves were held to their seatings by means of four coil springs arranged between the rings, but in the latest design as shown, the springs have been omitted.

An interesting fitting used on the Great Central is what is called an Intensifore lubricator which works in much the same manner as a hydraulic intensifier. Briefly, the arrangement consists of a container filled with oil upon which pressure is applied by means of steam acting on a plunger. Oil is led from the lubricator by suitable piping to distributors mounted on the foot plate, usually on the back head of the boiler. The distributors consist of sight-feed glasses fitted with suitable controls, from which the oil is led to the valves, pistons and also the driving boxes.

The continuous brake used on the Great Central is the automatic vacuum and the engines are fitted with a steam brake which may be worked separately or automatically with the train brake as desired.

The boiler is fitted with a flue tube Robinson superheater of 28 elements which are expanded directly into the cast iron header of the front cover type. The boiler is a standard type, and interchanges with two classes of 4-6-0 engines, having two inside cylinders, and with the large four-cylinder express locomotives previously mentioned. The working steam pressure is 180 lb., the combined evaporative and superheating surface is 2,387 sq. ft., and the grate area 26 sq. ft. The maximum tractive force is 29,950 lb., so that with 131,000 lb. on the coupled axles the adhesive factor is 4.45. The total weight of the engine is 178,000 lb., and with the tender fully loaded the total weight is 286,000 lb.

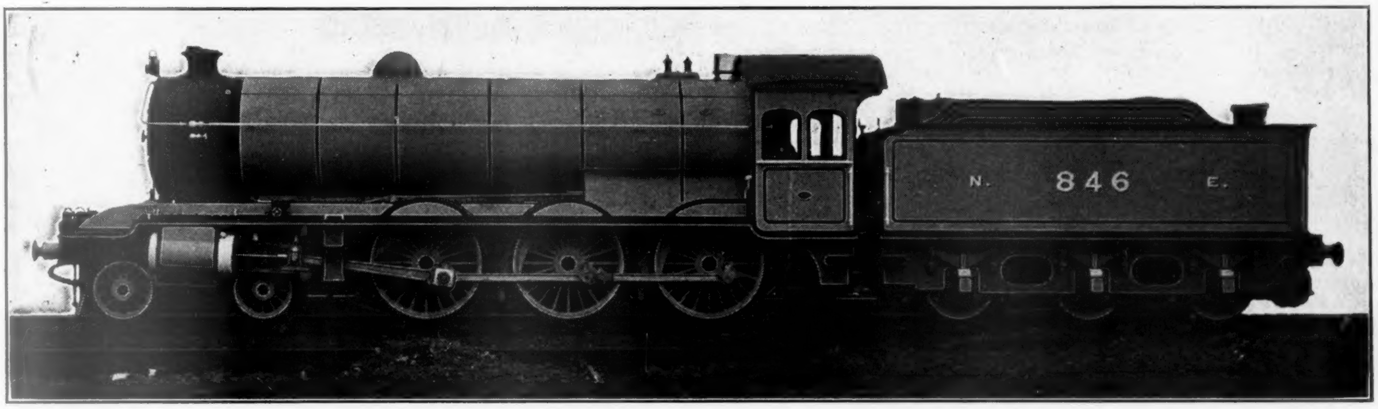


Fig. 3—North Eastern, Three-Cylinder, 4-6-0 Type Fast Freight Locomotive

Fig. 4—Caledonian, Three-Cylinder, 4-6-0 Type Express Passenger Locomotive

Three-Cylinder Locomotives for North Eastern and Caledonian

Fig. 3 illustrates a class of 4-6-0 type fast freight engines introduced on the North Eastern some two years ago, and built at the Darlington shops from the designs of the

chief mechanical engineer Sir V. L. Raven, who kindly supplied the photograph.

In common with all modern North Eastern locomotives, they have three cylinders which are formed in one casting. They are in line transversely, and all drive on one axle, the cranks being at 120 deg. to each other. The cylinders are 18½ in. by 26 in. and the three piston valves are each worked by separate sets of link motion. Reversing is effected by a steam gear. The coupled wheels are 68 in. in diameter, and the tractive force is 30,032 lb. The boiler carries a steam pressure of 180 lb. and interchanges with those fitted to the 4-4-2 passenger and the 0-8-0 type freight engines. The 0-8-0 type three-cylinder locomotives were described and illustrated in the *Railway Mechanical Engineer* for August, 1920, and as in general the new 4-6-0 locomotives follow closely the mineral traffic engines both in construction and design, a further detailed description is unnecessary.

The engines weigh 174,100 lb. in working order, of which 131,488 lb. are available for adhesion. The standard North Eastern self-trimming tender fitted with water scoop is used, the capacity of which is 5.25 tons (11,770 lb.) of coal, and 4,125 gal. (Imp.) of water. The Westinghouse brake acts on the engine and tender, and an ejector is also provided so that vacuum brake fitted cars may be handled.

Particulars of some trials made on the North British railway with a North Eastern 0-8-0 type three-cylinder mineral traffic engine may be of interest. The tests were made in August, 1921, and consisted in hauling loaded coal trains up a grade 6.7 miles long, the average gradient being one in 75 (1.33 per cent). The total length of the run was 8¾ miles. Three trips were made, the loads behind the tender being 31, 36 and 39 four-wheeled wagons, and on each occasion two 20-ton brake vans; the trailing loads were 617, 703 and 755 tons, and the start to stop times were respectively 35.5, 30 and 33 minutes.

On the first trip the engine was worked with a 53 per cent cut off, and on the second in full gear (cut off 75 per cent) till after passing a point about 3½ miles from the start, when the engine was pulled back to 65 per cent cut off, and on the third trip the engine was run in full gear throughout. For each trial the throttle was full open. A full boiler pressure was maintained throughout the first and second runs, and on the third it only dropped to 195 lb. during the last mile, when the second injector was started. There are 15 curves on this length of road, ranging from about 1 to 3 deg. With a steam pressure of 200 lb., these engines exert a maximum tractive force of 41,070 lb. It was considered an excellent performance to haul 755 tons at 12.1 m. p. h. up a grade of 1 in 75.

The Caledonian locomotive shown in Fig. 4 was completed at the St. Rollox (Glasgow) shops of the company last year. The engine is the first of a new class built from the designs of W. Pickersgill, the locomotive superintendent who kindly supplied the photograph. The engine is one of the most powerful 4-6-0 type built for express passenger traffic; in fact, there is only one class running having a greater tractive force. They are the four-cylinder engines of the 4-6-0 type on the London & North Western (Lancashire & Yorkshire section) having 75 in. wheels and 29,000 lb. tractive force as against 28,000 lb. for the new Caledonian locomotive.

The engine illustrated has three cylinders. They are all in line and drive on separate axles in contradiction to the plan adopted on the North Eastern. The center cylinder drives the leading wheels through a crank axle and those outside the center coupled wheels through connecting rods 11 ft. long as against 6 ft. 6 in. for the inside rod.

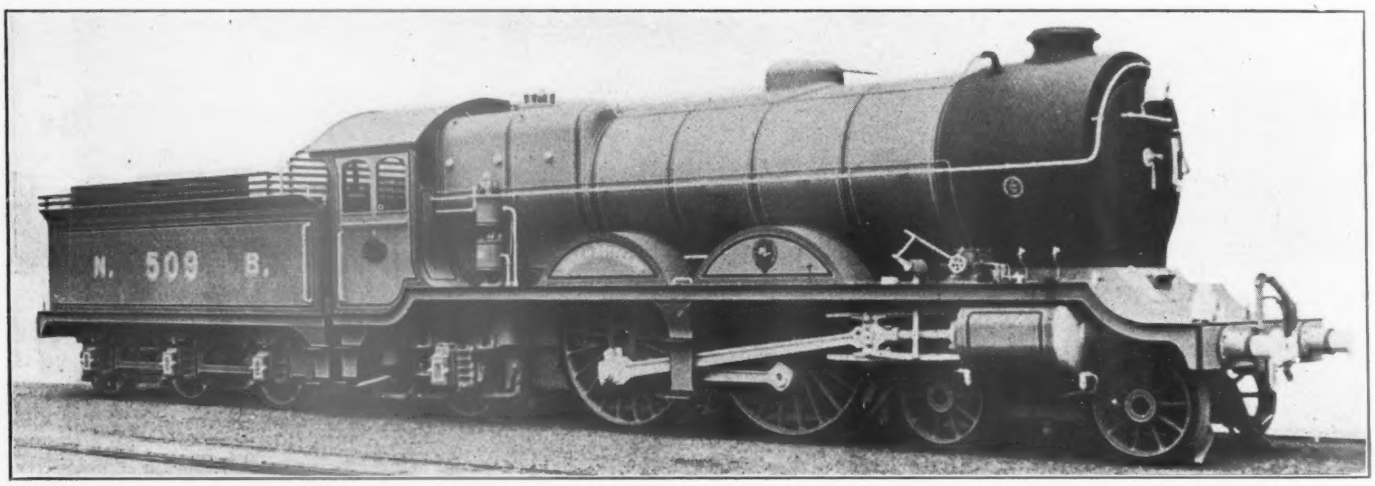


Fig. 5—North British, Two-Cylinder, 4-4-2 Type Express Passenger Locomotive

Steam distribution is effected by piston valves and two sets of Waschaert gear, the necessary motion for the valve for the center cylinder being obtained from the combined movement of the two sets of valve gear through a system of levers. Steam reversing gear is fitted which is standard practice on the Caledonian. The cylinders are each 18½ in. by 26 in., and the piston valves are 8 in. diameter. Automatic by-pass valves are fitted to each cylinder and large air valves are provided on the superheater header which open on the throttle being shut, thus allowing air to circulate through the elements, valve chests, and cylinders when the engine is drifting. The boiler which carries a working pressure of 180 lb. has a total evaporative heating surface of 2,370 sq. ft. and a superheating surface of 270 sq. ft. The grate area is 28.5 sq. ft. There are 24 5-in. flues for the superheater units, and in addition 203 2-in. tubes all of steel. The distance between the tube sheets is 16 ft. The Robinson superheater is used. The driving wheels are 73 in. and the truck wheels 42 in. in diameter. The total weight of the engine is 181,500 lb., of which 134,500 lb. are carried on the coupled axles. The adhesive factor is therefore 4.8 and with the tender fully loaded with 12,500 lb. of fuel and 4,500 gal. of water, the total weight of the locomotive is 276,000 lb.

The standard brake on the Caledonian is the Westinghouse, which acts on the engine and tender, but an ejector is provided as only the vacuum brake is used on many of the through trains between the London & North Western and Caledonian systems, and the arrangement is such that the application of the vacuum brake on the train operates the air brake on the locomotive.

Mention may be made of the fact that the valves, pistons, piston rods and the driving boxes for the leading and center axles are lubricated from an eight-feed mechanical lubricator, which is mounted on the running board, and receives its driving motion from a point in the valve gear where the return crank connection joins the link.

North British Atlantic Type Locomotive

The Atlantic type passenger locomotive, Fig. 5, is one of a series lately delivered to the North British railway by the North British Locomotive Co., Ltd., and constructed at the Hyde Park works, Glasgow. These engines have been built to the requirements of W. Chalmers, chief mechanical engineer, to whom the writer is indebted for the photograph, and are employed on important express services, particularly those forming part of the East Coast Route between Edinburgh and the North, which trains travel from London (King's Cross) over the Great Northern and North Eastern railways. These engines follow in general design those introduced some years ago, but differ in that they are superheated, and have larger cylinders. The tractive force is 23,400 lb. The cylinders are 21 in. by 28 in. and the valve motion between the frames is the ordinary link gear, piston valves being used. The boiler working pressure is 180 lb. The earlier engines of this type were introduced in 1906 and worked with saturated steam at 200 lb. and had 20 in. by 28 in. cylinders, so that the tractive force was 23,700 lb. Both lots have 81 in. drivers.

The saturated steam locomotive had 2,256 sq. ft. of heating surface, and the total combined evaporative and superheating surface of the superheated engines is 2,188 sq. ft. The grate surface in each design is 28.5 sq. ft. The overall dimensions of the boilers are the same in each case. The engines in both series carry the same weight, 89,600 lb. on the drivers. The new engines weigh 171,800 lb. against 166,800 for the earlier design, and the standard tender when loaded with 15,700 lb. of coal and 4,240 gal. of water weighs 102,700 lb. The brake used is the Westinghouse, and an ejector for the vacuum brake is fitted. The superheated engines have also mechanical lubricators for the valves and pistons.

2-8-0 Type Fast Freight Locomotive

The locomotive illustrated by Fig. 6 represents a new class introduced for working fast freight trains on the Great Western which are noteworthy for the fact that they are the first of the 2-8-0 type to be used for such work on a British railway. In general, these engines follow current Swindon practice, and existing standards were closely adhered to in their construction. The cylinders are 19 in. by 30 in. and outside steam pipes are used. Piston valves distribute the steam and are operated by the ordinary link motion placed between the frames, the four eccentrics being mounted on the second or driving axle. The coupled wheels are 68 in. in diameter. The first engine when built was equipped with the standard boiler as fitted to previous 2-8-0 freight engines having 56 in. wheels, but has since been returned to the shops and supplied with a new and larger boiler. The following tabulation shows the changes made consequent to this alteration.

COMPARATIVE HEATING SURFACES

	Original boiler	New boiler
Tubes	1,686.6 sq. ft.	2,062.35 sq. ft.
Fire-box	154.7 sq. ft.	169.75 sq. ft.
Total	1,841.3 sq. ft.	2,132.10 sq. ft.
Superheater	330.05 sq. ft.	323.90 sq. ft.
Grate area	27.07 sq. ft.	30.28 sq. ft.
Total weight	174,100 lb.	183,700 lb.

Fig. 6 shows the engine as fitted with the new boiler, the working pressure of which is 225 lb., which is the pressure used for all the larger classes of Great Western locomotives.

Ordinary underhung laminated or leaf springs take the weight and equalizing gear is used. The truck and two leading axle springs are joined, as are also those of the third and fourth axles. The Great Western is the only British line which systematically adopts equalizing arrangements, and in this and other respects, more particularly in truck and boiler design, and in the use of combined cylinder and saddle castings, Great Western locomotives resemble American practice.

The tender is fitted with a water scoop, has a tank capacity of 3,500 gal., and space for about 11,000 lb. of coal, and weighs full 89,600 lb. The vacuum brake operates on the engine and tender.

Great Eastern Passenger and Freight Locomotives

A. J. Hill, chief mechanical engineer of the Great Eastern Railway, has courteously supplied the writer with the photograph from which Fig. 7 has been prepared. The 4-6-0 type express locomotive, not illustrated, is the standard type used for working the heavier services on the line; originally engines of this design were introduced some years ago, but the new locomotives differ in certain details. In two respects these engines are distinctly novel, one is the unique length of the piston stroke, which is 28 in., being longer than that used for any other inside cylinder engines, except the 0-6-0 freight engines, Fig. 7; and secondly, in the position of the coupling rod pins which are on the same centers as the corresponding inside crank, instead of being placed at 180 deg., as is the usual practice.

It is well known to readers of the *Railway Mechanical Engineer* that exhaust steam injectors are widely used in British practice, and these engines form no exception to this rule. The cylinders are 20 in. by 28 in. and piston valves placed above are worked by link motion through the medium of rockers. Extended piston rods are used.

The Belpaire boiler, which carries a working pressure of 180 lb., has a combined heating surface, evaporative and superheater, of 1,896 sq. ft.; the area of the grate is 26.5 sq. ft. The coupled wheels are 78 in. and those of the truck are 39 in. diameter. The engines weigh 143,600 lb. in

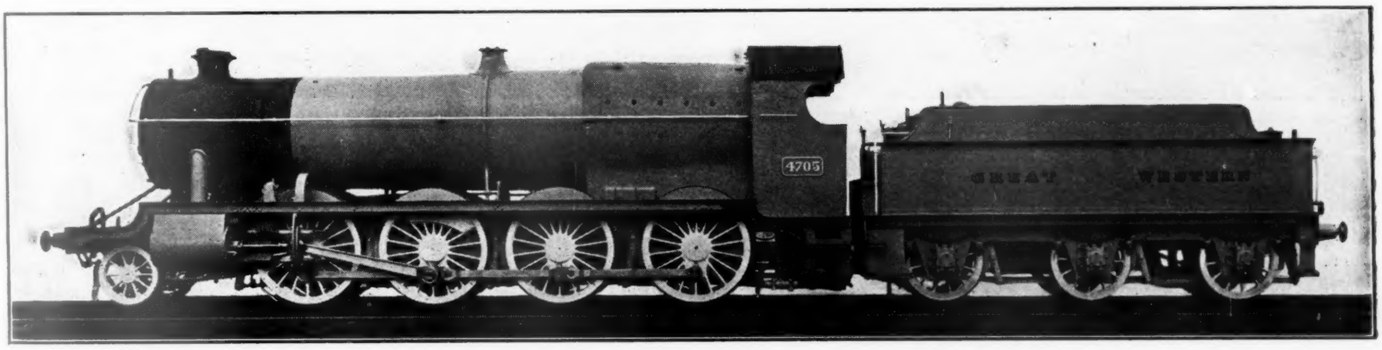


Fig. 6—Great Western, 2-8-0 Type, Fast Freight Locomotive

working order, of which 97,560 lb. are carried on the coupled axles, and as the tractive force at 85 per cent is 22,000 lb., the factor of adhesion is 4.4. The tender carries 3,700 gal. of water and 8,960 lb. of coal, and the total weight of the engine and tender loaded is 227,000 lb.

The 0-6-0 type locomotives, Fig. 7, of which a number have been built at the company's shops at Stratford, Essex, are especially interesting because they are the most powerful 0-6-0 locomotives in Britain, the tractive force being 29,044 lb. The boilers with which these engines are fitted are the same as those used for the 4-6-0 type. The cylinders are 20 in. by 28 in., and have piston valves. The valve gear is the ordinary link motion with rockers and reversal is effected by a wheel and screw, which is the most usual arrangement in British practice. Like the passenger engines they have superheater headers fitted with two automatic air valves, which can be seen just behind the smokestack. The coupled wheels are 59 in. in diameter and ordinary gravity sanding gear is fitted to each for forward running. The engine weight is 122,700 lb., and the total weight of the engine and tender, with the latter loaded with 11,200 lb. of coal and 3,500 gal. of water, is 208,000 lb.

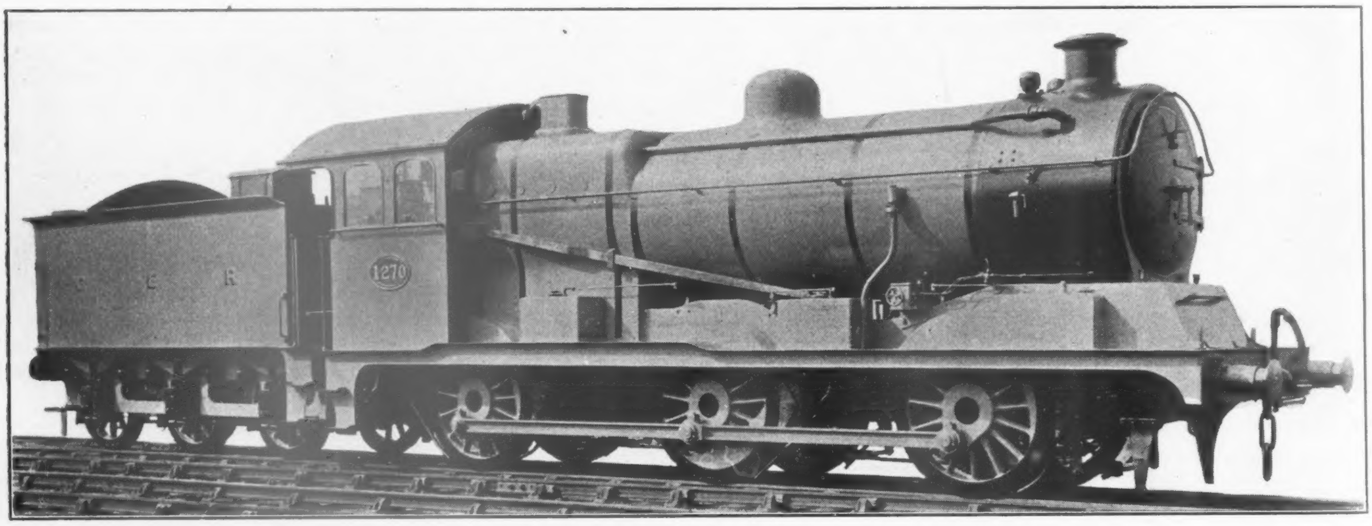


Fig. 7—Great Eastern, 0-6-0 Type, Inside Connected, Freight Locomotive

Valve Gear for Three-Cylinder Locomotives

In 1919 H. N. Gresley, locomotive superintendent of the Great Northern Railway, built at the Doncaster shops the first of a very interesting class of locomotives for fast freight service. The engines, which embody several novel features, and of which several have now been built, have three cylinders, and are of the 2-6-0 type. All three cylinders drive onto the center axle, that between the frames through a balanced built up crank axle, the cylinder center line being inclined at 1 in 8 in order that the main rod may clear the leading coupled axle.

Piston valves having inside admission distribute the steam, the three valves being operated by two sets of Walschaert gear applied to the outside motion. The manner in which this is accomplished is as follows: A lever of the first order rocking about a pivot in the horizontal plane is attached to the valve spindle, on one side of the engine. The free end of this lever has fulcrumed on it an equal armed rocking lever, also vibrated on the horizontal plane by being coupled to the valve spindle for the outside cylinder on the opposite side of the engine. The opposite or free end of the second named lever is coupled to the valve spindle for the center cylinder. The first lever is quite long, as it extends across the front of the engine, and the pivot is so placed that the travel at the end where it receives the equal armed lever is half the travel of the valve from which it derives its motion. The center cylinder valve in this way receives its motion from the movement of the other two valves combined. Through the equal armed lever it obtains a valve travel equal to those of the outside cylinders, and as the pivot of the equal armed lever is on the free end of the long lever, the position of the shorter lever fulcrum relatively to the cylinders is altered by the vibration of the longer lever.

The boiler is large for an eight-wheeled locomotive. The barrel is 72 in. diameter outside, and 11 ft. 5½ in long, and is made from a single plate ⅝ in. thick. The total heating surface of the boiler and superheater is 2,308 sq. ft. The grate area is 28 sq. ft. The cylinders are each 18½ in. by 26 in., the steam pressure carried is 180 lb., and the coupled wheels are 68 in. in diameter. This combination gives a tractive force of 30,030 lb. Great care has been exercised in the design of these engines with a view of keeping down weight, especially in the motion parts, which are made from chrome-nickel steel heat treated.

The crossheads work in guides of the three-bar type, and the crank pins for the return cranks of the valve gears are fitted with ball bearings. The total weight of the engine in working order is 160,800 lb., of which 134,400 lb. are carried on the coupled axles. The engine weight per square foot of combined heating surface is very low, being only 69 lb. as against 74.6 lb. and 103 lb. for two preceding classes of two cylinder engines of the same wheel arrangement. One of the engines of the three-cylinder design was illustrated in the *Railway Mechanical Engineer* for September, 1921, and the connecting rods were described in the May issue of the same year.

(To be continued)

LUMINOUS FIXED SIGNALS—letters showing on the front of a box—for use of air brake inspectors, at night, in signaling between the front end and the rear end, of a train standing at a station, are in use at Magdeburg, Germany, according to a note in one of the late numbers of the Bulletin of the International Railway Association, the data having been taken from a German paper. The letters, composed of dots formed by small electric lights, are energized through a circuit with push buttons (for closing the circuit and illuminating the signal) distributed along the platform in positions convenient for use with trains of different lengths. The letters are only three; F for applying brakes (Festlegen); L for releasing (Losen); E for finished (Erledigt). The arrangement is similar to that used at theatres and other public places for calling carriages by displaying numbers, different combinations of light being shown to form different letters.

Some Properties of Materials and Their Use

Influence of Investigations on Design; Allowable Stresses Should Be Based on True Elastic Limit

By J. M. Lessells

Railway Equipment Engineering Department
Westinghouse Electric and Manufacturing Company

THE importance of the designer being acquainted with his materials cannot be too strongly emphasized, and sufficient has been said elsewhere by others to give permanence to this idea. Usually the engineer has not the opportunity to compile comparative data for himself; consequently, this must be supplied him so that all the characteristics of the materials used in construction can be seen at a glance. Such is the method of some industrial companies who do applied research work. Another point requiring emphasis, because it is too often neglected, is the wealth of information which can accrue to the designer from a complete knowledge of the behavior of parts in service. In cases of failure the data forthcoming should render recurrence unlikely. Unfortunately, it is not always possible to conduct such investigations.

This work, however, demands the full co-operation of the designer, the metallurgist, the steel founder and the application engineer before success can be achieved, since all parties are involved. Therefore, in design work, if full advantage is to be obtained from experience in making the future product better, a searching after the truth is desirable, and a co-ordination of effort must be a necessary foreword.

In any structural member undergoing stress, failure to withstand the straining action may be due to one or a combination of causes: (1) Bad design due to a lack of appreciation of service conditions. (2) Material not according to specification. (3) Material not suitable.

Failure Due to Bad Design

There are three principal kinds of stresses encountered in service: (a) Stress due to dead loads. (b) Stress due to live loads. (c) Stress due to alternating loads.

Furthermore, these stresses may be either normal or tangential to a principal plane in the section under stress and, in certain cases, may act together. The problem in design, therefore, is always to reduce to an equivalent single load.

In conditions where normal and tangential stresses occur there are three theories as to when elastic failure takes place:
(1) A certain value of the maximum principal stress.
(2) A certain value of the maximum principal strain.
(3) A certain value of the maximum tangential stress, and if

p = maximum principal stress on a given section
$p1$ = maximum normal stress on the same section
q = maximum tangential stress on the same section
$\frac{1}{m}$ = Poisson's ratio

then the first condition will give

$$p = \tfrac{1}{2}\, p1 + \sqrt{\tfrac{1}{4}\, p1^2 + q^2} \qquad (1)$$

and the second condition will give when — = $\frac{1}{4}$

$$p = \tfrac{3}{8}\, p1 + 5/4 \sqrt{\tfrac{1}{4}\, p1^2 + q^2} \qquad (2)$$

and the third condition will give

$$p = \sqrt{\tfrac{1}{4}\, p1^2 + q^2} \qquad (3)$$

The value given in (2) is the one generally adopted.

Omitting, for the present the case of alternating loads, the attainment of a satisfactory design hinges on the question of whether the working stress is based on the ultimate stress or on the elastic limit stress of the material. This question has always led to controversies and it seems to warrant examination in detail.

In Tables I, II and III are given the physical test results on a .48 carbon steel of the following analysis:

C. — .48; Mn. — .62; P. — .06; S. — .037; Si. — .22

as forged, annealed and oil-treated, respectively.

TABLE I—PROPERTIES OF STEEL AS FORGED

Ult. stress lb. per sq. in.	Yield stress lb. per sq. in.	Elastic limit lb. per sq. in.	Elong. per cent	Red. per cent	Izod. ft. lb.
78,500	43,000	27,600	25	51	3
79,600	47,400	32,900	23.5	51.8	3
85,000	36,200	30,600	22.8	45	3
81,000 Av.		30,300 Av.			

TABLE II—PROPERTIES OF STEEL AS ANNEALED

Ult. stress lb. per sq. in.	Yield stress lb. per sq. in.	Elastic limit lb. per sq. in.	Elong. per cent	Red. per cent	Izod. ft. lb.
80,900	41,325	39,000	24.5	43.2	13
85,200	40,750	32,000	25.7	42.8	10
86,000	40,600	31,000	25.5	41.9	11
84,000 Av.		34,000 Av.			

TABLE III—PROPERTIES OF STEEL AS OIL-TREATED

Ult. stress lb. per sq. in.	Yield stress lb. per sq. in.	Elastic limit lb. per sq. in.	Elong. per cent	Red. per cent	Izod. ft. lb.
100,000	59,200	43,000	19	56	9
102,000	58,700	44,600	19.5	59	9
100,000	60,700	54,700	19	60	8½
100,700 Av.		47,400 Av.			

Let us suppose for the sake of argument that the working stress for this particular material is based on the ultimate stress rather than on the elastic limit stress; then supposing that the same material is being applied under similar conditions of service and let x, the factor of safety, sometimes called the factor of ignorance, be 3.

$$x = \frac{\text{Ultimate stress}}{\text{Working stress}} = \frac{ft}{fw} \text{ say}$$

then the working stresses for this material in these states become as follows:

Material as forged	f w = 27,000 lb. per sq. in.
Material as annealed	f w = 28,000 lb. per sq. in.
Material as heat-treated	f w = 33,000 lb. per sq. in.

and expressing these as a percentage of the elastic limit stress for the respective state—

Material as forged	f w = .89 of elastic limit stress
Material as annealed	f w = .82 of elastic limit stress
Material as heat-treated	f w = .69 of elastic limit stress

Referring to the micro-photographs Figs. 1, 2 and 3, which represent, respectively, these different states of this material—as forged, as annealed, as heat-treated—it will be seen that the material as forged, which has a very coarse grain structure, would have the highest ratio of working stress to elastic limit.

With the case of alloy steels, the conditions may be much worse, for taking the case of a 3½ per cent nickel steel in the annealed and heat-treated condition, the following divergence is usually obtained between the ultimate and elastic limit stresses:

Ultimate Stress	Elastic Limit	
74,000 lb. per sq. in.	26,000 lb. per sq. in.	Before treatment.
100,000 lb. per sq. in.	80,000 lb. per sq. in.	After treatment.

If the working stress is as before based on one-third of

the ultimate stress, then the material as forged will be overstressed, and permanent deformation will sooner or later occur. It is, therefore, evident that this condition of affairs is wrong and working stresses must be based on the elastic limit of the material if grave errors are to be avoided.

Coming now to the question of alternating loads, a new field is opened up. To the locomotive designer it is an important one because many of the structural members which combine to form the design are subjected to stress reversals. Typical examples are: (1) The reversal of tension and compression stresses in main and side rods. (2) The reversal of bending stresses in the axles.

Considerable attention already has been given to the elastic limit stress. It was understood, of course, that this was the stress determined by a tension testing machine. It will be known here as the "apparent" elastic limit for experiments on alternating stresses demonstrate the fact that there is a second elastic limit and that material can be made to fail although stressed to a degree less than the apparent elastic limit.

Quoting from the recent paper by Prof. H. F. Moore of the University of Illinois who found that for a .49 carbon material in a sorbitic state, the "true elastic limit," or as called by him the "endurance limit," was 48,000 lb. per sq. in., while the "apparent elastic limit" was 67,700 lb. per sq. in., it will be seen that due consideration of these changes must be given in design work.

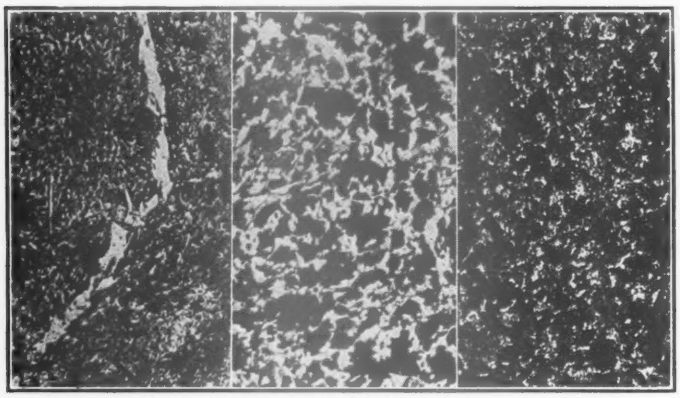


Fig. 1—Left—Material as Forged
Fig. 2—Center—Material as Annealed
Fig. 3—Right—Material as Heat Treated
Magnification 100 diameters

The author recently has been conducting a series of fatigue tests on axle material 6 in. in diameter in which it has been revealed that when a section of this size is properly annealed, there is no difference between the outer layer and the inner layers as far as resistance to fatigue propagation is concerned. The material was of the following analysis:

C. — 44; *Mn.* — .56; *P.* — .010; *S.* — .038; *Si.* — .16

This material was heated to 850 deg. C., held for three hours, and cooled in the furnace. The various test pieces were cut as shown in Fig. 4:

It will be noted that three tensile and Izod tests were taken at different distances from the outside. Each group of fatigue tests was formed into the following series: 1, 6, 7, 12; 2, 5, 8, 11; 3, 4, 9, 10 and 13, 14, 15, 16. The results of a few of these tests are given in Table IV:

Table IV—Tests of Annealed Axle Steel

Ultimate stress lb. per sq. in.	Yield stress lb. per sq. in.	Elastic limit lb. per sq. in.	Elong. per cent	Red. per cent	Izod. ft. lb.	Brin. No.
77,625	37,000	35,500	31.8	41.9	7	149
79,625	37,750	35,500	27.5	37.3	7	156
80,625	37,625	34,000	24.5	35	8	149

The outer layer, comprising the series of fatigue test pieces 1, 6, 7 and 12, gave an "endurance," or "true elastic" limit of 32,000 lb. per sq. in.

The inner layer, comprising the series of fatigue test pieces 3, 4, 9 and 10, gave an "endurance," or "true elastic" limit of 31,500 lb. per sq. in.

These points have been mentioned because in all good designs, these various characteristics have to be predetermined.

Material Not in Accordance with Specification

In view of the requirements of modern specifications, the case of a material not being in accord with these should be of rare occurrence, but is, of course, possible and, therefore, must be considered.

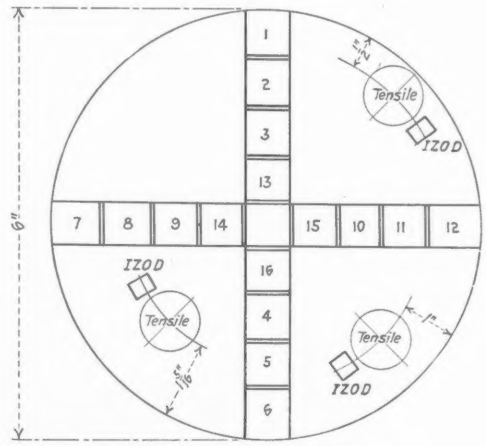


Fig. 4—Location of Test Specimens

Material Not Suitable

This phase of the subject is important because many failures in service have been due to ignorance as regards the materials used. Two cases will be given. (a) Application of non-ductile alloys, such as those of aluminum for high-speed pistons without considering the effects of temperature change. (b) Application of ferrous material in a coarse crystalline condition for a part subjected to shock.

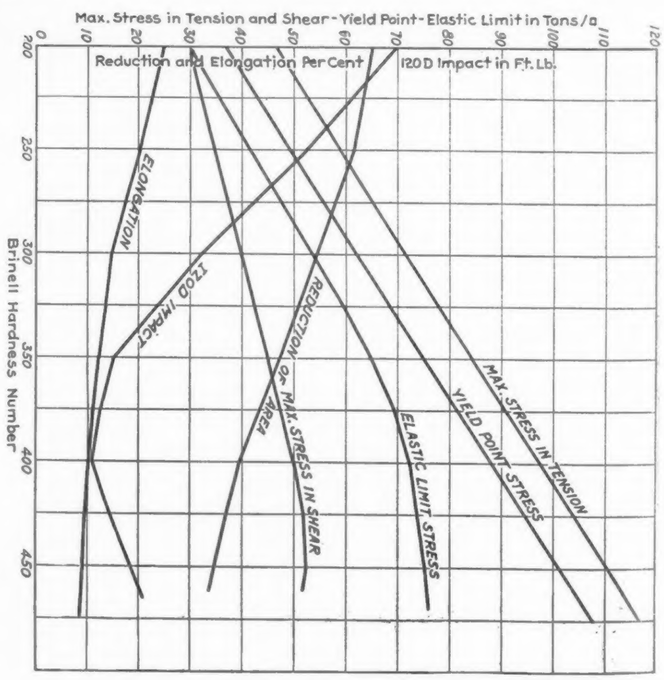


Fig. 5—Diagram Showing Results of Physical Tests

To eliminate such mal-applications therefore, it is neces-

sary for the designer to become better acquainted with the materials he uses. It is an excellent practice to have all salient points brought to the attention of designers by means of charts, an example of which is shown in Fig. 5.

It would be interesting to discuss the question of material specification tests, as a knowledge of materials is worthless unless used to secure correct material as well as correct design. However, this is beyond the scope of this paper.

Sufficient has been said to show that in addition to a good design a better knowledge of materials is important. When it is generally realized what the physical interpretation of the elastic limit represents and the conditions under which it may vary, working stresses will never be based on any other physical value.

Locomotive Driving Box with Adjustable Bearing

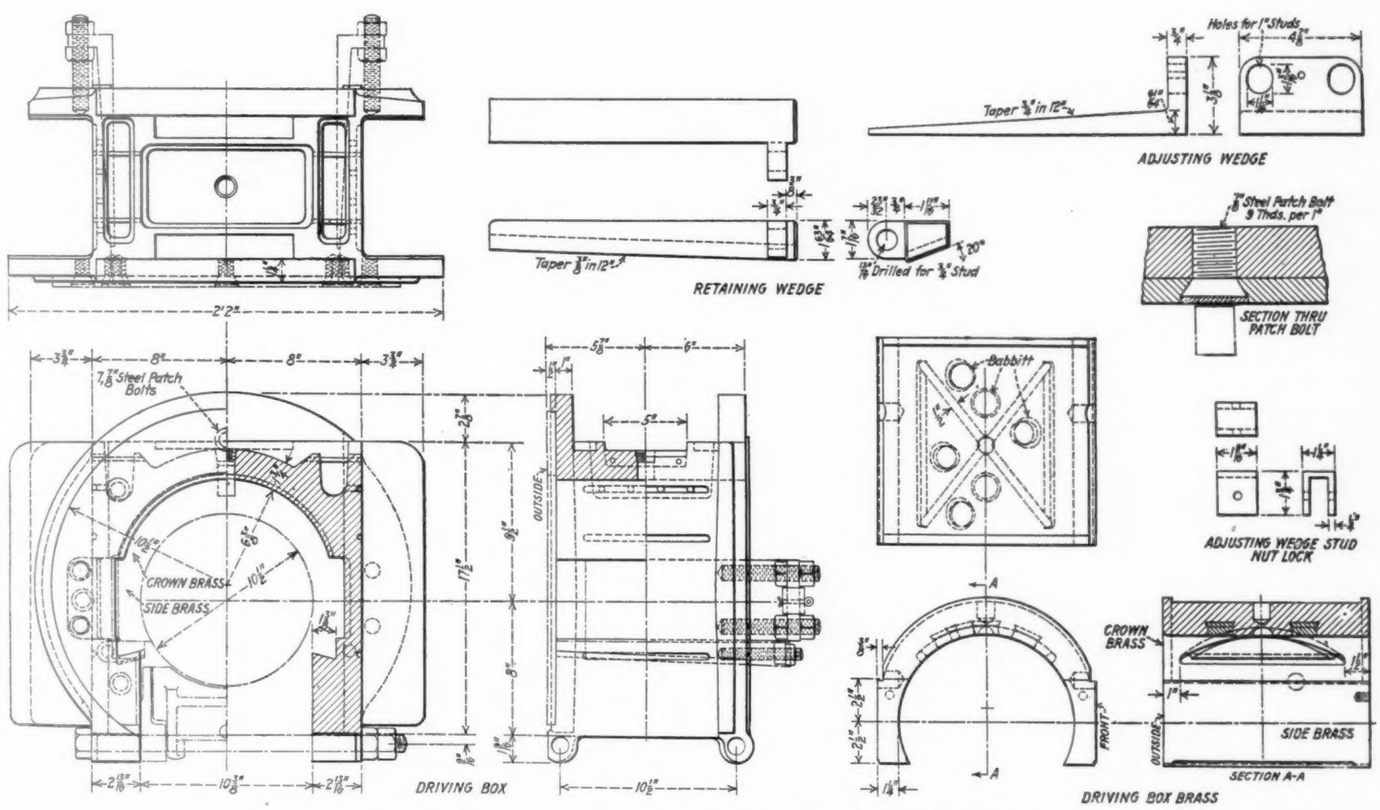
WHILE the heavy modern locomotive presents a very different appearance from one designed 20 or 25 years ago, many of the details have remained of the same general design. The locomotive driving box, for example, has been changed from cast-iron to cast-steel and its size and weight have been increased, but in other respects the modifications have been but slight. The bearing area of the crown brass is proportioned to the weight carried, but little provision is made to care for the enormous thrusts produced by the large pistons, high steam pressure, increased spread of cylinders and closer spacing of frames now commonly employed. Owing to the limited bearing surface on which the horizontal forces act, the wear is rapid and a pound soon develops. Furthermore, the usual method of securing the crown brass in the box, which has been retained from early days, makes it necessary to drop the wheels to remove the box for renewals of the brass. While the present design has the merit of simplicity and its faults have been tolerated, it can hardly be claimed that it is satisfactory.

In an endeavor to improve the situation, J. Murrin, superintendent of shops, and E. J. Brewster, general foreman of the Chicago & North Western, have designed a driving box which has adjustable side bearing brasses and which permits of the removal and renewal of the crown and side brasses without dropping the wheels.

This driving box, as will be noted from the accompanying drawing, consists of a cast-steel body tied together at the bottom legs by two 1-in. heat-treated bolts, instead of the usual cellar bolts, pulled tightly against the cellar to keep the box parallel. The brasses are in three pieces, the top or crown piece and two side or quarter brasses, located equally above and below a horizontal line drawn through the center of the axle. These three brasses are held solidly in position in the box by two taper retaining keys exerting pressure upwardly. The side brasses, which are about 5 in. wide and 1¼ in. thick when new, are adjusted by means of two taper wedges of ample width and thickness to give a solid bearing on the box and also to withstand the heavy thrusts imposed on them through the brasses.

To take up wear at front and back, it is only necessary to loosen the retaining keys and force in the adjusting wedges, which move the quarter brasses forward toward the journal. The wedges and retaining keys are held in place by studs, nuts, lock nuts and cotters. The adjusting wedges have a movement of 1½ in. each and, as these wedges are tapered ¾ in. per foot, this provides for a take-up of 3/16 in. for wear. When the brasses have become worn to such an extent that the adjusting wedges cannot travel further, a liner may be applied to the back faces of the quarter brasses, which will bring the wedges out to the original position and permit a further movement of the brasses toward the journal.

The complete brass may be removed from the box without dropping the wheels by first pulling the retaining keys and the adjusting wedges and removing the quarter brasses, then



Construction of Locomotive Driving Box With Adjustable Brasses

raising the driving box off the journal and removing the crown brass.

The crown brass is held in place by a 1-in. dowel pin, which projects from the inside of the box into a hole drilled in the top brass to receive it. It also has a flange on each side and these flanges, interlocking over the sides of the box-prevent the brass from moving endways. The quarter brasses are locked by a dowel, half on the edge of the quarter brass and half on the edge of the crown brass, which prevents them from moving endways. Boxes of this design can be bored on a boring mill to accurate dimensions and brasses can be finished and carried in stock for immediate use. This type of bearing provides about 30 per cent more bearing surface on the brass in line with the piston thrusts forward and back than the ordinary design.

The first box of this design was applied to a left main journal of a Pacific type passenger locomotive and the right main journal equipped with an old-style box in October, 1920. Since this time the right main box has had three new brasses applied and the left main brass of the new design is still in service. The locomotive has made approximately 25,000 miles between adjustments. The Chicago & North Western now has 25 locomotives in service with this style of driving box and 80 more under construction. It is stated that there has been no more trouble in regard to hot boxes or lubrication with these boxes than with those of the old style, as would be anticipated from the increased bearing area at the point of thrust which decreases the pressure per square inch on the bearing.

Water Treatment on the St. Paul

In many places the available water supply is very unsatisfactory for use in boilers. The country traversed by the Chicago, Milwaukee & St. Paul east of the Missouri river in South Dakota presents conditions which may be taken as typical of those under which railroads are frequently obliged to operate.

The few streams run slowly through lands so rich in the soluble salts of calcium and magnesium that the river waters are always hard, and the more the rainfall on adjoining lands and the higher the rivers, the harder the water. Because of the scarcity at or near the surface, most railroad supplies are derived from drilled wells, which vary in depth from 50 ft. to 1,500 ft. and in which the character of the water varies as widely. In the ground are two layers of sandstone whose horizontal cracks furnish the supply, the water from the lower sandstone being very hard (80 to 90 grains per gallon) and carrying also 20 to 60 grains of sodium sulphate or chloride, while the water from the upper sandstone so closely resembles the lower water after softening that it is presumed to be the same water softened in the ground; that is, by zeolitic action. This soft water is available, however, only in sections near the Missouri river.

The problem through a considerable district was one of securing an increased amount of water, as bad as it was, and of accomplishing something in the way of improving it. Additional wells were drilled at a number of points and the use of boiler compounds was resorted to. Results were not sufficiently satisfactory and it was decided to install a series of water treating plants. Seventeen plants are now in operation and they cover every water station in a district which includes about 400 miles of line.

The new plants are continuous in operation. All of the main line plants with the exception of those at two points, are designed to treat 15,000 gal. of water per hour continuously and consist each of a hard water pump; a 40-min. reaction tank within which the mixture of hard water and the necessary chemicals (all fed in continuous streams) is slowly stirred by mechanical means; a three-hour settling tank; a treated water pump which delivers to the track tank, and a chemical storage room; all strongly housed and heated.

The plant at Scotland, S. D., is typical of the main line plants. Everything is of wood except the machinery and pipe. The drilled well, 12 in. by 168 ft., under the pump room furnished water to a double-stroke deep-well pump which delivers it through a 6-in. pipe to the water wheel which does the stirring. The water, after passing the wheel, flows to the bottom of the mixing tank where, as it rises, it meets in succession the continuous streams of milk-of-lime, sodium carbonate and ferrous sulphate solutions.

Hydrated lime is used in water treating to extract the carbonic acid, which brings about the precipitation of the scale-making limestone carbonates down to three grains per gallon or less. Sodium carbonate (soda ash) is used to replace completely the scale-making limestone sulphates by non-scaling sodium sulphate. Ferrous sulphate (green sulphate of iron) is used for the treatment of the last three grains of calcium carbonate so that it will not clog the injector or branch-pipe; this, by converting half of the calcium carbonate into calcium sulphate.

In these plants, these reagents are all fed by regulated streams of water from the pipe which supplies the water wheel. The milk-of-lime box holds 480 gals. of water for a five-hours' supply (at Scotland 400 lb.) and this is fed continuously by a small stream of water entering at the bottom of the lime box and overflowing near the top through a 2-in. pipe to near the bottom of the mixing tank.

Once every hour, an hour's supply of dry hydrated lime is added to the supply in the box. This method produces an hourly variation in the rate of lime feeding, but the stirring in the mixing tank is so thorough and so prolonged (45 min.) that only a slight variation is found in the water as it overflows from the top of the mixing tank to the bottom of the settling tank.

The dry soda ash rests on a shelf in the soda box and is fed to the mixing tank by a spray. The supply on the shelf is replenished hourly. The sulphate of iron is fed in solution from its box by a small stream which enters at the bottom and overflows near the top.

The best method of feeding any reagent to a treating plant is determined principally by its solubility in water and in all cases the thinner the solution or mixture the better. The arrangement of feeding devices described above is not theoretically perfect, but has been adopted as the result of experience in handling railroad plants which are frequently miles from a repair shop and are seldom operated by skilled mechanics. The uniformity of results is the best proof of the wisdom of the design and method.

The water, with its chemical reactions practically complete and its precipitate ready to settle, arrives at the bottom of the settling tank and there commences to leave its precipitate as the water slowly rises to overflow through the perforated collecting pipe to the treated water pump in the pump room, whence it is delivered to the track tank.

The settling tank is freed of its accumulated sludge once daily by opening for 30 seconds the valves controlling the system of perforated sludge pipes lying in the bottom of the settling tank. The perforations are in the bottom of the sludge pipes, and the branch pipes are connected to the main pipes by street-ells so that they are close to the floor of the tank.

The treating plants were built by company forces at an expenditure of approximately $18,000 for each of the larger plants and $7,000 for the smaller ones. Since their installation boilers have been free from scale and from leaking, and almost free from foaming. Boiler repairs are now almost nothing and during the entire strike period no boiler troubles attributable to water were reported on this district.

Traveling Engineers Hold Thirtieth Convention

W. O. Thompson, Secretary, Honored; Papers on Oil-Burning Locomotives, Power Distribution and Air Brake Defects

A REMARKABLE tribute to his constant service in behalf of the Traveling Engineers' Association throughout the 30 years since the organization had its inception, was paid by the members and friends of the association to W. O. Thompson, the secretary and only living charter member, at the opening session of the 1922 convention, held at the Hotel Sherman, Chicago, October 31 to November 3, inclusive. A three-quarter length portrait of Mr. Thompson, in oil, was presented to the association. In accepting, the association voted to have the portrait hung in the convention hall at all future meetings. The presentation was a complete surprise to Mr. Thompson.

The convention was called to order by the president, J. H. De Salis (N. Y. C.), who, after the invocation addressed the association in part as follows:

President De Salis' Address

"The greater part of our members serve as instructors of locomotive engine crews, and personally observe the performance of the locomotives and the crews operating them. Their responsibilities cover all parts of the locomotive and its proper operation, both from a mechanical and transportation standpoint. The traveling engineer is required to be a specialist on the many devices that go to make up the successful and economical operation of a train.

"Education for the men holding these positions is necessary. Their duties place them in a position where mistakes cannot be corrected; they must act right the first time. If the train is not started in the proper manner the mistake means broken draft rigging or broken cars. If the train is not stopped properly it may mean derailment or collision, and if a train is not properly operated when running it may not make the schedule time or will cause a loss of fuel. At these conventions are brought out the best methods of educating engine crews. In the proceedings is found the best practice for the successful operation of trains, and a book published by this association entitled 'Standard Form of Examination for Firemen' is being used by many railroads for the examination of new men and of candidates for promotion."

W. O. Thompson—New York Central Secretary

Early History of the Association

Following Mr. De Salis' address, a brief resumé of the early history of the association, prepared at the request of the executive committee, was presented by Mr. Thompson, of which the following is an abstract.

A short time after the adjournment of the Master Mechanics' and Master Car Builders' convention in 1892, a road foreman of engines of one of the lines running into Chicago listened to a conversation between his master mechanic and a representative of the Westinghouse Air Brake Company relative to the good work accomplished at the convention and how beneficial it was for a man engaged in the railroad business to meet with other men in the same branch of the business from all parts of the country for the purpose of exchanging their views and experiences.

The conversation led the listener to think that if the Master Mechanics' Association was of such inestimable value, why would not an association of traveling engineers be of even more importance, not only to the traveling engineers, but to all departments of the railroad.

Acting on the thought, he started out to find traveling engineers enough to form an association, and, strange as it may seem with our membership of over 1,500 in the United States, Canada and Mexico, he was over three months in getting the names of 14 traveling engineers who were in favor of the idea.

After the 14 traveling engineers had been heard from, a meeting was held at Chicago, November 14, 1892. The result of that meeting was the forming of a temporary organization. During the meeting an invitation was received from Sinclair and Hill, of Railway & Locomotive Engineering, to meet in their office in New York City to perfect a permanent organization. This meeting was held on January 9, 1893, and 53 members were enrolled.

During the first few years of the association's existence its condition was rather precarious. At that time the newly created position of traveling engineer was not looked upon as an actual necessity by the managements of many railroads. In the panic of 1894 and 1895 approximately 70 per cent of our membership was set back to running engines and had it not been for the hard, painstaking work of a number of our members, the almost immediate popularity of reports and researches of our committees, the loyalty of a few of the higher railroad officials, the press and a few of the railway supply firms, the association would have died in its infancy.

The benefits to the traveling engineer have also been great. Thirty years ago he was considered nothing more than an engine-tamer and trouble-doctor, but today he is considered an indispensable adjunct of any well-organized railroad.

The association has grown from a membership of 53 to 1,536. During its life 575 members have been selected to

fill higher positions on railroads or in other businesses. In all of the 30 years there has never been a decrease in membership. Nearly all of the members who have been promoted to higher positions continue their membership, thus giving the association their moral and financial support. Considering these facts, the pride which the traveling engineers feel in their association is pardonable.

J. H. DeSalis—New York Central
President

Frederick Kerby—Baltimore & Ohio
1st Vice-President

T. F. Howley—Erie
2nd Vice-President

W. J. Fee—Grand Trunk
3rd Vice-President

Portrait of Secretary Thompson Presented

At the close of the paper, D. L. Eubank (Galena Signal Oil Company) unveiled and presented Mr. Thompson's portrait to the association. In his remarks leading up to the presentation he brought out the fact not mentioned by Mr. Thompson in his paper that the author was in large measure responsible for the organization of the association and for its healthy growth during the early years of its existence.

On behalf of the members, tributes were paid to Mr. Thompson's service to the association by L. D. Gillett (Dominion Railway Commission of Canada) and D. R. McBain. Members of the Traveling Engineers' Association, of the Railway Equipment Manufacturers' Association, and the Hotel Sherman participated in providing the portrait.

Operation and Maintenance of Oil Burning Locomotives

In the operation of an oil-burning locomotive attention should be given to avoiding sudden and great change in fire-box temperatures. The fireman, by inattention in letting the steam drop back and then forcing the fire to bring the steam up again, not only wastes fuel, but works a great hardship on the boiler. Owing to the rapidity with which the temperature can be dropped by cutting down the fire it is of utmost importance to have the engine crew give special attention to the use of the dampers and handling of injectors or feedwater heaters and the blower to prevent abuse of the boiler. In starting a train, the locomotive burning oil can develop its maximum power without fear of holes being torn in the fire by heavy exhaust at long cut-offs, as in a coal-burning locomotive; but if careful judgment is not used in handling, this feature will adversely affect fuel economy by producing uneconomical acceleration.

The fuel oil should be heated to about 100 deg. F. in the tank to give the best results, although with the use of very heavy oils it has been necessary to heat the oil to 150 or 180 deg. F. Excessive heating damages the oil by driving off the lighter gases and causing the asphaltum to separate from the lighter oil. This makes the flow irregular and it is difficult to carry a light fire when drifting or standing.

Frequent sanding of the flues to prevent accumulation of soot promotes economy. Sanding should be done where there is no hazard of starting fires and when the engine is working under heavy conditions at a long cut-off. The intervals between sanding depend upon conditions of operation.

The operation of the firing valve and atomizer require close attention to take care of the varying boiler load, due to changing cut-off. Careful attention in the use of the atomizer and firing valve will eliminate black smoke, except where mechanical defects interfere. Heavy black smoke is not only a direct fuel loss, but rapidly deposits soot on the flues which interferes with the heat transfer to the boiler. A clear stack is deceiving. It may mean only a small amount of air, or it may mean as much as 300 per cent excess. Under operating conditions, it is good practice to regulate the supply of air until a very light brown haze is shown at the stack, which will reduce the amount of excess air and thereby produce economy in the use of fuel. The presence of smoke does not always mean insufficient air. Poor atomization, poor mixture of air and oil, unconsumed oil striking cooling surface and poorly designed or bricked fire-pan frequently cause smoke when the air supply is far in excess of that required.

Burners should have sufficient air admitted around them to prevent them from becoming heated to a temperature causing carbonization of the fuel at the mouth of the burner, resulting in deflecting the oil spray. The best results have been obtained with a burner located at a point from six to nine inches above the floor of the fire-pan. Burners should be properly alined with the fire-pan to strike the center of the flash-wall and should be inspected frequently, by inserting a hack-saw blade in the oil port to insure that there is no foreign matter to prevent the maximum amount of fuel being delivered when required.

The fire-pan should be free from all leaks, except the air openings provided for the combustion of fuel. Leaks, in many cases, cause the brick work to become loose. If bricks fall into the bottom of the fire-pan they deflect the oil spray.

Fire clay, asbestos and fine sand should be used in lining brick work of the fire-box and fire-pan. These should be mixed in proportion of two parts clay, one part of sand and one of asbestos, and stirred to the consistency of a thin paste. The brick should be placed as closely together as possible. Large quantities of fire clay mixture should not be used at any one point or depended upon entirely as a heat-resistance surface. After the brick setting has been completed, all exposed surfaces should be coated with a solution of soda ash and water, mixed until it will flow freely. This glazes and makes a very satisfactory fire-resisting surface.

Much can be accomplished in maintaining the brick work by having the fire-pan properly braced.

Should any carbon be found on the flash-wall, this should

be removed to permit the oil spray to come in contact with a reasonably clean wall.

The formation of carbon is oil striking the brick work or some obstruction in the fire-pan before it had time to burn. There is a noticeable increase in the amount of carbon formed when very heavy asphaltic base oils are used. This is probably due to the fact that these are heavy and slow-burning. Decreasing the openings in the fire-pan and thereby increasing the velocity of air entering the fire-pan has reduced carbon formation, as it hastens combustion.

Both small and superheater flues should be inspected frequently, as there is a possibility of sand collecting in the large flues when there are leaks in the front end. Any restriction in the flues will affect superheating and evaporating efficiency.

If an oil-burning engine is properly drafted and the firebox properly bricked to prevent the localization of high temperatures, the cost of maintenance is about the same as that of a coal-burning engine.

In comparing the operation of an oil-burning locomotive with a coal burner, the locomotive burning oil has a number of distinct advantages: (1) Reduction in the amount of smoke; (2) absence of cinders; (3) largest type of power can be operated without the mechanical stoker; (4) less loss of fuel at the stack; (5) the hazard of starting fires along the right-of-way is reduced; (6) with careful handling the steam can be kept closer to the maximum boiler pressure without frequent or prolonged openings of the pop valve; (7) it permits the fireman at all times to observe signal indications and operating rules; (8) the use of oil permits a more accurate check of the fuel consumption, which is of great value in compiling individual performance records of enginemen, firemen and locomotives; (9) quicker turning of the power may be accomplished with the use of oil and terminal charges reduced because of the reduction in hostler service and the elimination of ash-pit service; (10) it permits a better system and lower cost of fuel distribution through the use of pipe lines.

The use of oil is also conducive to longer locomotive runs, as for equal heat valve oil occupies much less space than coal. Furthermore, oil when stored does not lose its heating value as does coal, nor are there any difficulties arising from disintegration as with coal.

The report is signed by J. N. Clark (Sou. Pac.), chairman; J. C. Simino (Sou. Pac.); J. C. Brennan (N. Y. C.); E. F. Boyle; W. G. Tawse (Superheater Co.), and Dumont Love (F. E. C.).

Discussion

The principal points brought out by the discussion, were the necessity for care in firing up the oil burning locomotive to avoid the risk of gas explosions in the firebox, the value of the stack cover for retaining heat in the boiler when the locomotive is in the terminal and a doubt as to whether the risk of roadway fires is entirely eliminated.

The practice outlined to avoid explosions in firing up oil burning locomotives, particularly when the fire is to be lighted in a hot firebox, is first to open the blower valve, open the fire door, then turn on the atomizer and finally open the oil valve after a piece of burning waste for igniting the oil has been placed in the firebox. The blower and the open door permit a sufficient volume of air to pass through the firebox to prevent the accumulation of gas which may be formed in the hot firebox should the oil be slow in igniting.

The use of stack covers does not seem to be general practice although a number of roads use them to some extent. Instances were cited where, by the use of the stack cover, it has been possible to retain sufficient steam pressure in the boiler after from 8 to 12 hours to permit the engine to be fired up with its own steam in the atomizer.

L. D. Gillett (Dominion Railroad Commission of Canada), raised the question as to the fire hazard of oil burning locomotives, stating that in Canada an investigation of fires in oil burning territory had developed the fact that burning tar has been thrown from the stack in quantities sufficient to set fire under favorable conditions, and that a change in the refinery process has eliminated the trouble. The discussion thus started brought out the need of supervision to insure that cigarettes or cigar stubs, pieces of waste, etc., be not thrown into the sand box, and thence into the firebox and out the stack only partially consumed, to set fire along the right-of-way and on the adjoining property. Through certain agricultural districts where considerable grain is grown, the Southern Pacific uses netting in the front ends of its locomotives during the dry season as a precautionary measure against the small sparks thrown out when sanding the tubes. Although it is evident that fires can be set from oil burning locomotives, the consensus of opinion of the members who have had experience, is that the risk is incomparably less than with coal burning locomotives.

Poor Distribution of Power Increases Operating Costs

At more or less frequently recurring periods, every railroad is confronted with a situation where its ability to earn revenue is controlled by its ability to move the traffic offered. Likewise periods occur when surplus equipment represents a large overhead investment producing no revenue. Any plans that will contribute toward improving these conditions will help greatly in reducing the general cost of operation.

A study of the power situation with a view to conserving tractive effort on the railroad system as a whole, without reference to particular conveniences or economies on a single division, is of paramount importance. Records of fuel and locomotive maintenance cost will show that, generally speaking, where the size of the train is limited, the smallest type of engine that will comfortably handle the train will give the lowest annual operating cost for fuel, wages and repairs, and in turn will release the heavier type of power for trains where the loading is controlled only by the tractive effort of the engine. Investigation has shown instances of comparatively heavy engines handling very light local passenger trains, with lighter engines handling tonnage freight trains on other divisions, perhaps for the reason that the engineman returned on a heavier run, or because that particular division inherited that particular class of power as a result of some changes in the power distribution on the district as a whole. Changes in power distribution or extending the run of locomotives over two divisions have in such cases brought about considerable saving in tractive effort and as a result decreased the cost of operation.

Locomotives having a large reserve of power for the trains they are required to handle, or more modern in design, can be in less than average good condition and yet make the time without failure. Furthermore, small types of more or less antiquated power are not popular at the general shops for overhauling, for the reason that the more modern types are usually in demand, and it is easier to figure on what they will require in repair parts. The motive power officer on the division has for his yardstick man hours per locomotive despatchment and engine failures, rather than the total cost of operation per 1,000 gross ton miles or per passenger car mile, and naturally is not vitally interested in the question as to whether some other type of locomotive would do the work more economically.

It has been stated by eminent authority that the loss to the farmers of the United States, through not being able to move their crops when markets are favorable, amounts to about $400,000,000 annually, and yet railroad officers find them-

selves at certain periods with considerable surplus of power. These considerations, together with the fact that the average miles per locomotive day for freight locomotives in 1920 was 59.3, gives to the subject of power utilization a compelling interest, any discussion of which will naturally resolve itself into consideration as to the merits of pooled vs. regular engines, of long runs vs. division runs, and many other things. oughly familiar with the operating conditions on the railroad as a whole and make his recommendations accordingly, without reference to division economies which disregard the general good to be accomplished. Compound engines or engines equipped with certain special devices, while giving excellent service where regularly used, may prove of negative benefit when thrown into a group of engines of similar tractive power perhaps, but unlike in design or equipment. This is especially true where there are many new men not entirely familiar with the types of locomotives or devices.

J. N. Clark—Southern Pacific
4th Vice-President

J. B. Hurley—Wabash
5th Vice-President

D. Meadows—Michigan Central
Treasurer

One feature to consider in engine assignment is that engines having a large reserve of power for the trains assigned to them do not call for the same refinement in the handling and firing that will obtain where it is necessary to have skillful handling in order to deliver the desired service. This absolutely works out in practice. The fuel used at terminals and in stand-by losses represents probably 30 to 35 per cent of the total and increases with larger power on light trains.

The cost of locomotive operation for a representative mid-western road for the year 1920, which will also be fairly representative of 1922 conditions, was as follows:

	Total cost for year	Cost per loco. owned per annum
Fuel	$28,789,756	$13,158
Repairs	26,462,086	12,094
Wages—enginemen, firemen and enginehouse employees	18,442,173	8,429
Lubricants	424,917	194
Other supplies	335,696	153
Total of selected items	$74,454,628	$34,029

This represents average costs applied to all locomotives owned. If this were shown only for the locomotives in actual service or for the heavy freight locomotives in service, the average cost would be much higher.

The St. L.-S. F. has for some time made up a daily cost sheet for each freight train operated. This shows the cost per 1,000 G. T. M. for fuel and wages, including overtime. This information reaches all division operating officers, including the road foremen of engines, daily, and is very valuable in keeping individual fuel and wage costs before all concerned, including enginemen and trainmen.

On the majority of roads the operating or transportation department distributes the power, working with the motive power department, which usually approves of the individual engines to be assigned to divisions or runs, but this is not always the case in transfers of power between divisions or districts. A very close working arrangement is necessary if the best results are to be obtained. Transfers of power are sometimes, if not usually, made at times of rush business when new men are entering the service, both in the shops and on the road. A transportation officer without training in locomotive matters cannot fully appreciate all that is involved in introducing new types of locomotives into new territory. The experience of men with the training of the traveling engineer is very valuable in such times and should be utilized. The traveling engineer so advising should be thor-

A number of roads have increased the available power supply through lengthening locomotive runs. This will not apply equally on all roads, but has great possibilities under certain conditions. This practice has been very much extended since our 1921 meeting, and the experience of the members is invited in the discussion to follow. Local conditions, as to train schedules, conveniences for taking coal and water, the grade of fuel used and facilities for caring for the fire and ash-pan enroute, must be considered. It is a fact that enginemen and firemen are assigned to runs rather than to engines and the difficulty in actually having regular crews on engines has increased, thus making it difficult to secure satisfactory mileage from regularly assigned engines to runs. It is safe to predict that where the character of the fuel used will permit, the tendency of operating departments of railroads will be to develop the fullest information as to the desirability of extending the length of runs for locomotives in passenger and fast freight service, but particularly in passenger service. The experience of the New York Central Lines, with which two members of your committee are connected, has been that to date the average monthly mileage of all passenger locomotives has not increased as a result of running certain engines over two divisions, although individual engines will make large mileage for a period. There is a saving in fuel due to decreased terminal consumption and the supervision given toward maintaining good condition of fires enroute to avoid delays for steam. We suggest the possibilities of extended runs for locomotives be made a subject for next year's convention.

Segregating certain types of engines to one district or division, instead of mixing up different classes in one territory, has its advantages. This may appear to impose a hardship at first if the engines are new to the district and somewhat more difficult to maintain and to operate than the engines regularly or previously used, but if done at a time when business is not too heavy and when experienced men are on both sides of the engine, and a high standard of inspection and repairs can be built up, it is a paying proposition. It is the practice, also, on some roads to work fairly close on power at all times. The motive power officers themselves insist on this, thus keeping the largest possible reserve of power laid up in good order for rush periods. It costs

money to take engines out of storage, and it should not be done without knowing that they are actually needed.

The roads referred to also maintain pooled freight engines throughout the year rather than assigning regular crews to engines during slack periods and then having to pool them when a rush comes on. The principle involved is that of maintaining a more rigid average year round system of inspection and repairs at terminals than would obtain with regularly assigned engines for certain seasons of slack business, and when we more or less depend on the engineer's report and personal interest to help maintain the power than when running pooled engines. However, when forced to return to pooling it is hardly possible to build up quickly the inspection and the method of caring for repairs or to keep the same degree of interest alive among the engine crews that obtains with regularly assigned engines or with a highly developed plan of pooled service. The advent of newly promoted enginemen and new firemen is an important point to consider and it is always to be remembered that the period of rush business is when the earning capacity of the locomotive is the greatest and when we should be able to get the best possible use from it.

The report is signed by Robert Collett (N. Y. C.), chairman; David Meadows (M. C.); W. R. Garber (K. & M.); J. E. Ingling (Erie), and C. A. Fisher (G. N.).

Discussion

The discussion of this report centered very largely around the subject of long engine runs, in which it is evident that the members of the association are taking a deep interest. Several cases of passenger runs of from 250 miles to over 600 miles were cited, and a number of cases were also cited where freight locomotives were running over two districts. The longer runs mentioned were in oil-burning territory on the Southern Pacific and the Missouri, Kansas & Texas. It developed that in several cases the extension of the length of the locomotive run has required an increase in the size of the cylinder lubricator. The four-pint lubricator has been found too small for large passenger power and in some cases six pint lubricators are being installed. This matter has offered no real obstacle, however, as extra oil is placed on the engine for use in case the original filling may not be sufficient to carry the locomotive over the entire run.

On the New York Central passenger locomotives are being run through from Harmon, N. Y., to Syracuse. This has saved turning 40 locomotives a day at the Rensselaer terminal (Albany, N. Y.), at an average cost of from $6 to $9 each, with a corresponding reduction in the number of movements between the roundhouse and the station, a distance of one mile over a busy double track bridge. Car department employees fill the main pin grease cups and shovel the coal forward at the Albany station in an average of from five to seven minutes. The locomotives have a short layover at Syracuse and return to Harmon in less than 24 hours. This practice has not necessitated any increase in the engine house force either at Harmon or Syracuse. On the two divisions, trains which formerly required 21 locomotives to handle are now being taken care of with 16 locomotives. No case was cited in the discussion where the practice, once established, had been discontinued because of the inability to overcome any of the difficulties encountered, although the shopmen's strike has interfered with the development of the practice in some cases. Although numerous difficulties have been encountered, the consensus of opinion of those members of the association who have had experience with it, indicates that some increase in locomotive mileage may be expected, that train miles per locomotive failure need not be decreased by the longer runs and that engine house expense will be reduced. Definite opinions as to what effect the long runs will have on fuel consumption and locomotive maintenance were not brought out. It was suggested, however, that where the long runs include more than one division the responsibility for maintenance would be divided and that the long runs would tend toward pooling of the passenger power.

The Baltimore & Ohio has had considerable experience with assigned locomotives in freight service. Prior to the strike mikado locomotives were assigned to regular crews on one division and mallets on another, with good results in both cases. It has been found that regularly assigned engines spend less time at the terminals than pooled engines. To save time and insure despatching without delay to the crew, machinists are assigned to the inspection pits to do as much repair work as possible while the inspection is being made and the engine is awaiting movement to the house.

Some Defects of the Air Brake System

The fundamental purpose of the railroad is to save time. The starting and stopping of trains are complementary factors in the problem of time saving, and it is evident that the best results can be obtained where both factors are given due consideration. Unfortunately, the brake is usually looked upon as a safety device only and, because of this idea, its maintenance does not receive the consideration it merits.

Insufficient consideration is given to the importance of correcting defects before trains leave the terminal. It is far better from every standpoint to spend a few minutes in the yard correcting defects than it is to spend hours in delays on the road. When a train leaves the yard, it should be in condition to go through to the next terminal without delay, due to improper brake action. Proper time for this work should be allowed, not while the train is being made up, but after the make-up is completed.

The business of the railroad is to move trains. Trains cannot be moved unless they can be controlled. The effectiveness of the control will determine the speed and number of trains. It will determine the number of cars which may be successfully operated in each train, as well as their weight and variation in weight from the empty to loaded condition.

The importance of brake pipe leakage, as it affects the operation of the brakes and fuel consumption, is generally underestimated.

When the engineman makes a brake pipe reduction and places the brake valve on lap, he is powerless to prevent the effect of break pipe leakage on the train. It is important that this point receive more attention on long and heavy trains than on the shorter ones, not only to avoid trouble during the application of the brake, but also to decrease compressor wear and steam consumption, to insure the ability to release all brakes in the train and to shorten the time of release.

It is customary to determine the amount of air leakage from the brake pipe by making a 10-lb. reduction, lapping the brake valve and noting the rate of drop of brake pipe pressure. Knowing the volume of the brake pipe, it is possible to calculate the cubic feet of free air lost from the brake pipe during the first minute after the brake valve is placed in lap position. This figure is commonly accepted as a measure of the relative condition of trains on the road with respect to leakage from the air brake system.

An extended investigation of long freight trains has developed the fact that the information so obtained may be rather misleading than otherwise. Trains are frequently encountered on which the brake pipe leakage, as noted above, may not be excessive, the indication being that the locomotive compressor capacity is ample to supply the air required for maintaining the pressure in the brake system, but subsequent observation on the road demonstrates that the compressor capacity is insufficient to supply the air lost.

Attempts to measure the amount of air leaking from the

entire system (including brake pipe and auxiliary reservoirs) by charging the brakes to 70 lb. and then placing the brake valve handle in lap position does not give satisfactory results, because where there is considerable leakage some brakes will apply while the brake valve is in lap position and the leakage then observed is from the brake pipe and only those reservoirs on cars where the brakes do not apply. This uncertainty makes tests of this character of no value.

In order to avoid the difficulties encountered in attempting to observe the leakage from the system by noting the drop in pressure on the brake pipe gage, such leakage is now determined by measuring the amount of air passing into the brake pipe to supply the leakage.

The permissible amount of leakage from the entire brake system is a question each individual road will have to decide. Too much leakage must not be allowed or an undesirably large compressor capacity or high degree of compressor maintenance will be necessary. An exceedingly low amount of leakage must not be insisted on or traffic will be interfered with on account of the time required to stop the leaks.

For instance, a 5-lb. pressure drop from the brake system, which would mean about 20-lb. pressure drop from the brake pipe volume alone, will not materially interfere with the application and release of the brakes, yet 5 lb. of air leakage from a 100-car train will amount to 65 cu. ft. of free air per minute. This amount of air leaking from the system of a 100-car train in one minute would not interfere with the operation of the brakes, as far as application is concerned, but it might seriously interfere with the release of the brakes, since it reduces the ability of the compressor by 65 cu. ft. of air per minute to raise the pressure in the brake pipe at the rate required to insure release. In fact, the compressor may have but little, if any, margin above that required to replenish the leakage. The time required to release the brakes on a freight train is a variable quantity. It can be said, however, that the time is usually underestimated, and the time the brake valve is left in release position is overestimated. Instruct an engineman, when releasing brakes, to place the brake valve in release position and leave it there 15 sec., and it will usually be found nearer 10 sec. than 15. The natural tendency to hasten the movement of the train makes the time seem longer than it really is, and an effort is made to start the train before all brakes have had time to release. This places great strain on the draft gear, frequently severe enough to cause parting of the train.

At how low speed brakes can be released without liability of damage depends on how heavily they are then applied, the amount of excess pressure, the length of the train, whether slack is in or out, and whether track conditions are favorable for releasing. Where retaining valves are in use, it is practicable to release at somewhat lower speeds than where they are not. While the head brakes always start to release before the rear ones, the retaining valves cause a much slower fall of brake cylinder pressure than when they are not in use, and this causes the slack to run out more smoothly. The most favorable conditions for releasing the brakes are when the train is standing, with maximum excess pressure and the brakes almost fully applied. The difficult release is when the brake pipe pressure is very low, as when the engine has been cut off for some time, or after a burst hose, train parting or an emergency application, because of the large amount of air required to raise the pressure in the brake pipe and in the auxiliary reservoirs of all early releasing brakes above the pressure in the auxiliary reservoirs of the late releasing brakes, particularly those at the rear. To insure release, a quick and considerable rise of brake pipe above auxiliary reservoir pressure must be had. In trying to get this to the rear after a light application, the head brakes are sure to be overcharged, so that some will reapply. Where a light application is made, the excess pressure should be increased before attempting to release.

No attempt should be made to release the brakes on a long freight train while running following an emergency application, no matter how high the speed may be. In case the brakes are applied from the train, place the automatic brake valve in emergency position, shut off steam and ascertain the cause. A hose may have burst, the train may have parted, or the conductor's valve may have been opened.

It may be of interest here to state that it requires to apply the brakes on a 100-car train of 10-in. equipment with a full service application approximately 205 cu. ft. of free air. Assuming the average leakage from the brake system at 40 cu. ft. of free air per minute, then every five minutes as much air is consumed by leakage as is required to apply the brakes with a full service application. If this train of 100 cars be kept charged while on the road 12 hours, it will consume in leakage alone about 28,800 cu. ft. of free air, or enough to apply the brakes with a full service application 144 times. From this we can see that the actual amount of air used in operating the brakes as compared with that wasted by leakage is very small, indeed. Furthermore, when we begin to appreciate more fully the expense entailed in unnecessary fuel consumption, compressor wear, poor train control and delay to train movement on account of air leakage from the brake system, then, and then only, will proper attention be given to overcome this leakage. We avoid the cost of a good tight pipe job, of close inspection and competent repairing, but burn more coal and waste much time. We must do more than make rules about these things. We must have the right kind of men, enough of them, and encourage them by giving them the right kind of tools, the materials and a proper place to do work.

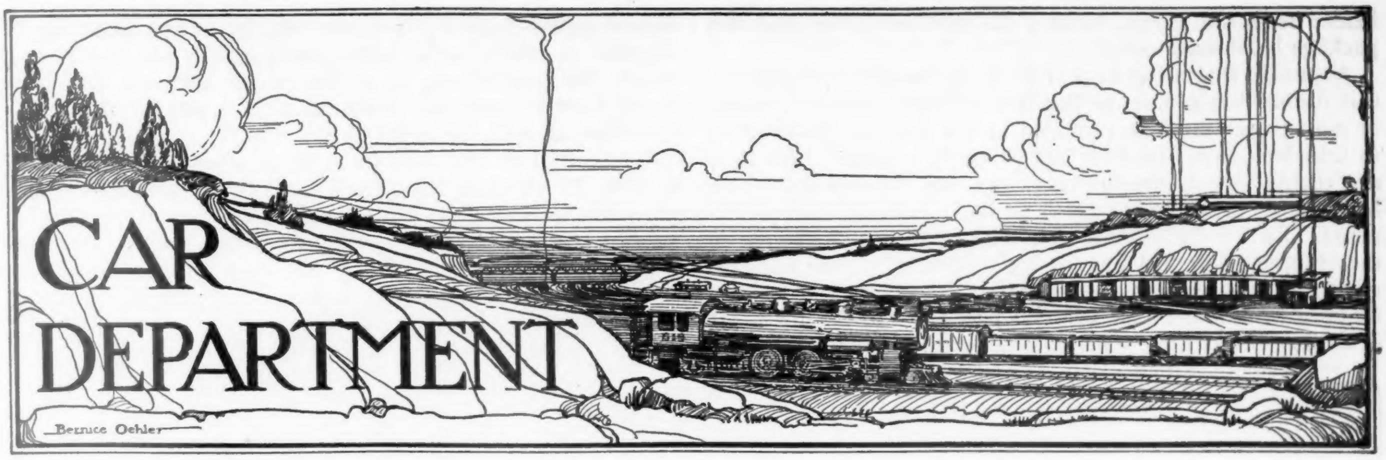
The report is signed by B. J. Feeny (Illinois Central), chairman; T. F. Lyons (N. Y. C.), L. M. Carlton (Westinghouse Air Brake Co.), W. W. Rush (D. & R. G. W.) and Wm. Owens (New York Air Brake Co.).

Discussion

In discussing the methods of testing for brake pipe leakage in transportation yards, several exceptions were taken to measuring the air required to supply the leakage rather than noting the drop in gage pressure with the brake valve lapped. The point was made that any means of measuring the air supplied to the brake pipe was likely to be too complicated to be practicable in the transportation yard, although such a test would be desirable where it could be made before the locomotive is attached to the train. Attention was also called to the fact that, as stated in the paper, a reduction of 5 lb. per sq. in. from the entire brake system, including the auxiliary reservoir volume, would be equivalent to a reduction of 20 lb. in the brake pipe pressure with the brake pipe volume alone, and that since most of the leakage is in the brake pipe, it is important to know the rate of pressure reduction with the brakes applied and the engineer's valve in the lap position, since this rate of leakage determines the extent to which the engineer can control the brake cylinder pressure. For this reason the Air Brake Association test, in which the brake-pipe leakage is noted with the brake valve lapped following a 10-lb. brake pipe reduction, was advocated.

There was considerable discussion as to the proper handling of the brake valve following the application of the brakes from the train. Cases were cited in which, by the prompt release of the locomotive brakes through the independent brake valve following the emergency application caused by a break in two, it has been possible to keep the locomotive and 10 or 15 cars which had broken away, out of the way of the rear end of the train. Generally speaking, about the only variation from the practice recommended in the report is the lapping of the brake valve instead of putting it into emergency position, which is the rule on several roads.

(Abstracts of other reports will be given in future issues.)

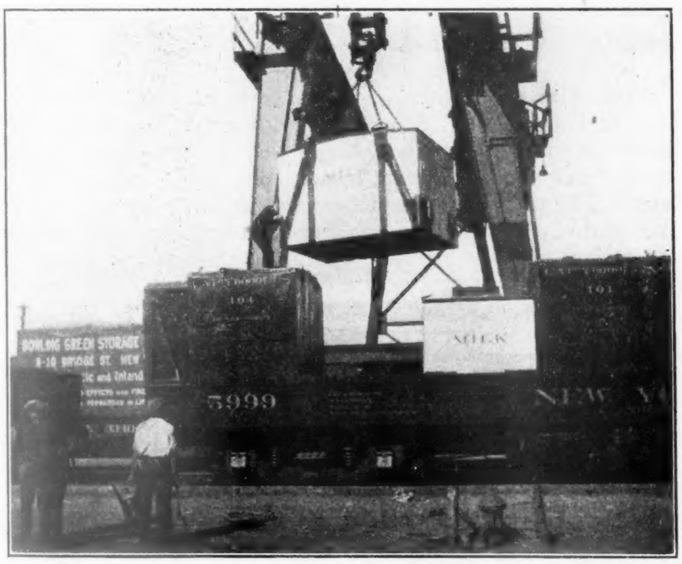


Recent Developments in Use of Container Cars*

Saving in Manual Handling by Container System—Application to Transportation of Milk in Bulk

By F. S. Gallagher
Engineer of Rolling Stock, New York Central

THE container system of handling L. C. L. freight is too young to enable any definite or concrete figures in connection with costs to be given, but I will endeavor to draw a word picture that will show the economy and



Loading a 600 Gal. Milk Tank Container

safety effected through the handling of less than car load freight by the container system.

The L. C. L. method of handling less than car load freight, permitting the unloading of a car in a few minutes, will be very far reaching, taking into consideration the railroad equipment of the country and the inability of the railroads to control this equipment during the peak load of business, when, in some cases, it is known the shippers use the car as a temporary storage place, tying up equipment that is badly needed. This results in a loss to the railroad company for car revenue which it would have had if the car had been unloaded promptly and returned to service, and an expense to the public at large due to the inability of the railroads to handle promptly shipments because of the lack of equipment.

With the use of the L. C. L. containers, this condition should be greatly reduced, if not altogether eliminated, because the containers can be removed from the car, immediately taken to the shipper's warehouse, and while there might some day be a demurrage charge for holding the containers, it would not keep the rolling stock out of service. In other words, the container methods of handling freight permits the quick unloading, and, of course, the quick unloading permits the quick return to service of the car, and during periods when there is a shortage of cars, which is almost chronic, the quick unloading of the freight car is a benefit to all concerned—the railroads, the shipper and the public.

Thirteen Manual Handlings for Each L. C. L. Shipment

Few people realize the number of times that L. C. L. freight must be handled from the shipper to the consignee. Following one package from start to destination, we will find it is manually handled as follows: (First) From the packing room to the warehouse platform; (second) from the warehouse platform to the wagon by hand truck; (third) from the hand truck into the wagon. The wagon then proceeds to the freight house, and the next manual handling (fourth) is from the wagon to the freight house platform; (fifth) from the freight house platform to the hand truck. The individual package must be weighed and proper record made, and then taken into the car (making the sixth movement). The seventh handling would be the stowing into the car. The car is then sealed and moved to destination.

The next handling (eighth) is the unloader lifting the freight to the floor of the car for the hand trucker; (ninth) the hand trucker carries this freight to a designated place in the freight house. When the consignee calls for the goods the hand trucker takes the shipment to the wagon for loading (tenth handling). When the package is delivered by the hand trucker to the wagon loading platform, it is dumped at the tail gate of the wagon (eleventh handling), and must be handled the twelfth time to place it into the wagon. At the consignee's receiving platform the goods must be un-

*Address delivered before the Society of Terminal Engineers, New York, October 10, 1922.

loaded from the wagon, making the thirteenth time that this package has been handled.

Assuming that a car load of L. C. L. freight is 20,000 lb., this means that it must be handled manually lifted 13 times, or man power must be provided to lift 260,000 lb. in order to transfer one car load of 20,000 lb. of freight. This does not include the numerous checkings and records that must be made of this freight, which in itself is a big item of expense. By the container system the container is delivered to the shipper, who will have a light overhead crane or some other means of carrying the container into his warehouse, so that one handling of the original package into the container is all that is necessary. The expense of crating is eliminated.

Gondola Cars with Slight Modifications Are Well Adapted for Holding Containers

Being loaded with one handling of the freight, the container is lifted by hoist from the floor of the shipper's warehouse to the truck and is lifted by hoist from the truck to the car.

At destination, the operation is just the opposite. The container is lifted from the car onto the truck and then from truck to the consignee's platform, where it is unloaded and is ready for return shipment, or the container is ready to be picked up by the truck for the use of some other shipper. While the container is being unloaded the truck is released.

Instead of having to handle this container shipment of L. C. L. freight thirteen times by man power, it is handled twice, saving on the same basis as before; that is, on a car load of L. C. L. freight weighing 20,000 lb., the man power lifting of 220,000 lb. This is an economy that we cannot lose sight of, and while it would be said, of course, that there will be an expense incident to the installation of equipment for handling these containers at shippers' and consignees' plants, when this equipment is once in, the expense ceases.

Saving on Loss and Damage

We are all familiar with the enormous amount of money returned to the shippers by the railroads and by the express companies on account of loss and damage to freight. In L. C. L. freight it amounts to more than 8½ per cent of the revenue. The express companies pay claims to the amount of $25,000,000 a year for loss and damage. A great portion of this can be saved by the container system, because there is no chance of damage if the goods are properly packed in the container unless there is a disastrous smash-up, and no chance of loss en route from the shipper's platform to the consignee's platform.

Containers for Shipping Liquids

There are other commodities handled by the railroads beside L. C. L. freight, express and mail where the container should play a big part; that is, in the handling of liquids, especially milk, fruit juices, edible oils, acids, etc., where the temperature is an important factor. The New York Central now has containers arranged for the transportation of milk in bulk.

The container and tank for milk or other liquids is shown in Fig. 1. A glass lined tank built by the Pfaudler Company of Rochester, N. Y., is used, but is encased in an insulated container. Time saving and labor saving is accomplished in every operation of handling milk or liquid by the use of the container car tank. The liquid being placed in the tanks at the proper temperature and the container being properly insulated, eliminates the use of ice.

These tanks may be made as large as may be transferred over the highways. In actual service all of the containers from the car will be hoisted and placed on a motor truck regularly in about a minute or a minute and a half per container. To transfer the same amount of milk between truck and railway car in the standard ten-gallon cans would

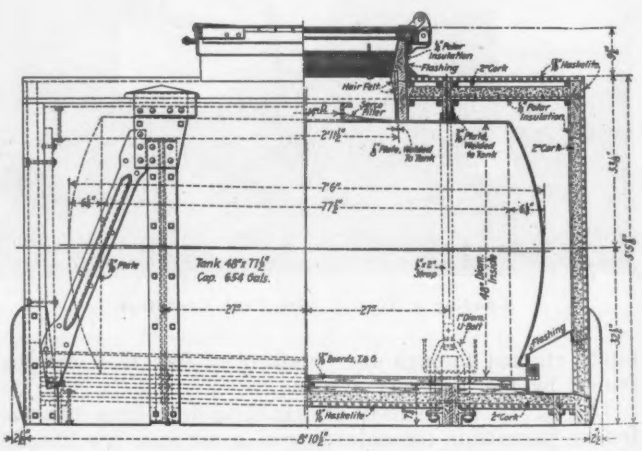


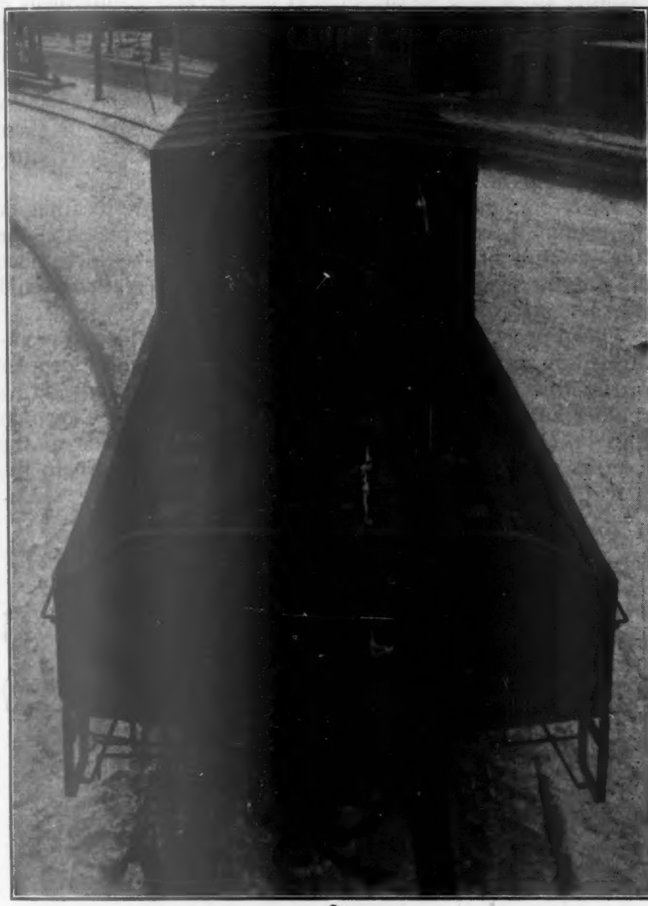
Fig. 1—Container and Tank for Milk

require over two hours in manual labor. The cleaning of one of the large containers could be accomplished within five minutes, while it would require fully an hour to clean 60 cans required to carry 600 gallons of milk. Platforms requiring extensive space for handling the ten-gallon milk can will be done away with.

Any milk station shipping 600 gallons or more, or multiples of any designated size of tank, could utilize the con-

tainer car tank service and lessen the handling at the shipping point and at the receiving point. The limiting feature of a liquid container would simply mean the capacity of the truck for transferring over the highways. The tank can be made to carry in bulk any amount: 600, 1,000, 1,500 or more gallons of milk.

There is no chance of getting water into the container, because the top of the Pfaudler glass-lined tank is sealed and locked, and in addition a regulation refrigerator car ice hatch plug is used for insulating purposes. This plug is dropped into the opening and then the container cover is fastened down and sealed.



Container Cars for Mail Service Have a Wire-Mesh Floor

With regard to the actual handling of L. C. L. freight by the container method, a tariff was arranged for between Chicago and Cleveland, and the container system of handling freight put into regular service. The containers were handled as I described, thus making a store door delivery, or in proper words, from store door to store door delivery. This system of handling L. C. L. freight is now in operation between New York and Buffalo and intermediate points, where the "from store door to store door" handling of L. C. L. freight is made possible, and all the equipment that is necessary to put this system in operation is the crane for lifting the container from the car, and at the shipping or consignee's plant the container can be left on the truck and unloaded, but if they have lifting means it would be quicker and cheaper to lift the container from the truck and place it on the shipping or receiving platform, releasing the truck for other work while the container is being loaded or unloaded, as the case may be.

These containers are 7 ft. wide, 9 ft. long and 8 ft. high, and they have a carrying capacity of 7,000 lb. This keeps the gross weight within the carrying capacity of a five-ton truck. They are made of steel throughout, except the floor, which is made of laminated wood. The containers are well braced, and there is very little chance of damage with ordinary handling.

By the container system, when we can arrange for the proper equipment for handling the containers, a car can be unloaded and released for service in a very few minutes; also it will permit the shipper and consignee to transfer or haul their goods from their warehouse or to their warehouse, as the case may be, by auto truck, without waiting at the freight house and without the loss of time necessary to load the truck with individual packages, because it will take only about a minute to load the truck when goods are shipped in an L. C. L. container, thereby saving an hour or two in getting the goods from or to the railroad.

Protecting Draft Gear from Solid Impact

By Wendel J. Meyer

In his paper on the design of steel freight cars before the Railway Club of Pittsburgh* John A. Pilcher, mechanical engineer, Norfolk and Western, stressed his opinion that cars receive their greatest damage from impacts in switching service and advocated limiting the switching speeds rather than attempting to design a car to meet any speed the trainmen might use. According to the speaker, the switching speed should be limited to the capacity of the draft gear in order that it should never be allowed to go solid. Each time the gear goes solid, it sustains damage, making it less efficient for its next impact, and so on until it is so badly damaged that it ceases to protect the car.

From tests conducted by the Inspection and Test Section of the United States Railroad Administration, speeds at which two commercial gears will go solid when applied to cars of 143,000 lb. gross weight each, vary from 1.87 m.p.h. to 5.09 m.p.h. (see Fig. 61 of "Report of Draft Gear Tests"). The report shows that the closing capacities were as follows: One type at 5 m.p.h., six between 4 and 5 m.p.h., six between 3 and 4 m.p.h. and four under 3 m.p.h. From this might be deduced a limiting speed of about 4.5 m.p.h. but since the gears tested were new and in excellent condition and moreover, since the most widely used types were closed at from 3 to 4 m.p.h., the limit would need to be reduced to at least 3.5 m.p.h. if not to 3 m.p.h.

Observers have agreed that impact speeds of from 5 to 10 m.p.h. are common in switching service. To enforce a speed limit as low as 3 m.p.h. would require an army of supervisors and even the supervisors would wink at this low speed limit if it were a question of speed limit or time limit to make up a train. A practical limit, one which could be adhered to and enforced, would need to be around 6 m.p.h. This speed is greater than the capacity of any commercial gear. Therefore, it is necessary to protect the draft gear from solid impacts and to design the car to withstand these. It should not be difficult to design the car to meet such service, for in the draft gear tests two 70-ton cars, equipped with dummy couplers and with solid steel blocks instead of draft gears, seemed to have withstood impact at 8 m.p.h. without excessive damage.

The coupler horn was devised originally to protect the draft gear and attachments by delivering the solid impact to the striking plate, buffer block and end sill and so to the ends of the center sills. The transition from wood to steel construction brought about the application of the draft gear

* *Railway Mechanical Engineer*, October, 1922, page 633.

attachments directly to the center sills. With the advent of the friction draft gear came the idea that the coupler horn was no longer needed and so its function and design were neglected. It was considered that the solid impact should be taken by the coupler shank and draft gear and delivered by the rear follower to the rear lugs and so to the center sills. Indeed, this opinion is still held by many to be correct; the statement is often made that the coupler horn never meets the striking plate because ¼ in. clearance is provided between them. Such a statement is not true to fact.

It is true that on new cars it is customary to apply the draft gear attachments so that there is an initial clearance between coupler horn and striking plate, but this clearance is not maintained long after the cars are in service. A little

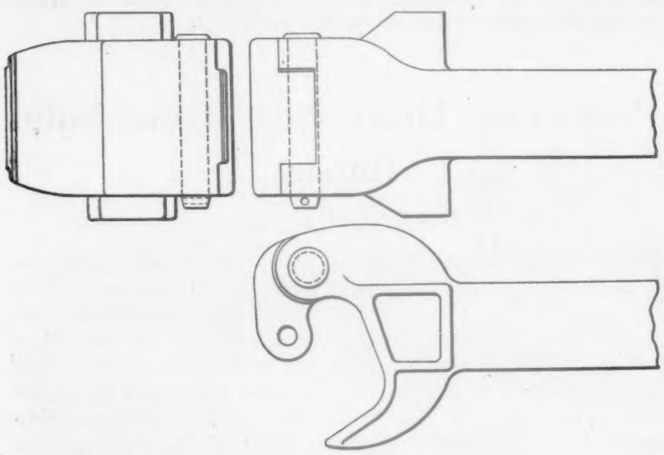


Fig. 1—Coupler with Horn at Top and Bottom

observation in any railroad yard will verify this. Almost every car will show evidence that the horn and plate have been in contact. The writer knows of a repair order of 2,000 cars, 80 per cent of which had broken striking plates. Mr. Pilcher stated that he had measured 16 couplers taken at random and had found that the shanks had been upset from ¼ in. to 1 in. Add this upsetting or shortening to the deformation of draft gears, followers, draft lugs and rivets and it is obvious that the clearance between horn and plate cannot exist very long. Moreover, by referring to the "Report of Draft Gear Tests," we find that in the drop tests the gears

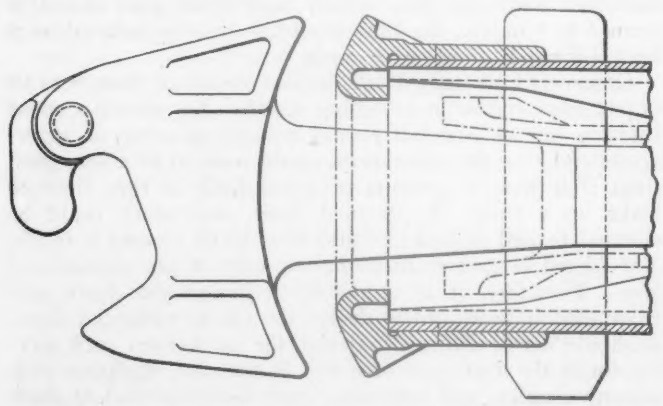


Fig. 2—Coupler with Curved Horn at Each Side of the Head

began to show signs of failure when the 9,000 lb. tup fell just a few inches more than the height which closed the gears (see Fig. 38 of "Report of Draft Gear Tests")—a positive proof that the draft gear is incapable of taking the solid impact.

From the above evidence it is obvious that the draft gear and coupler shank must be protected so that they cannot be subjected to solid impact and the only logical protection is a properly designed coupler horn. The present horn is improperly designed for use on modern steel cars.

In recent years, importance has been laid upon the area and stress ratio of the center sills. This stress ratio is based on the area and section modulus of the sill and the distance from the center line of the coupler to the neutral axis of the sill section. No account is taken of the distance from the neutral axis to the center line of impact between horn and striking plate and so the present stress ratio requirement is without basis or logic while the coupler horn is in its present location. The present horn causes the force due to solid impact to act along a line about 4½ in. above the center line of the force acting on the resilient draft gear. The stress ratio should therefore be based on the resultant of these forces, but a sill properly designed to meet such a requirement would need be of unusually large section.

Therefore, the only logical remedy is the re-location of the coupler horn so that its impact shall take place on the line of action of the draft gear force. If this should be done the present stress ratio and its method of calculation would then be correct.

The proper location of the coupler horn could be accomplished in a number of ways: (a) by providing a coupler carrier iron cast integral with the striking plate and adding another horn at the bottom of the present head as shown in Fig. 1; (b) by placing a curved horn at each side of the head as shown in Fig. 2, or (c) by making the horn in the

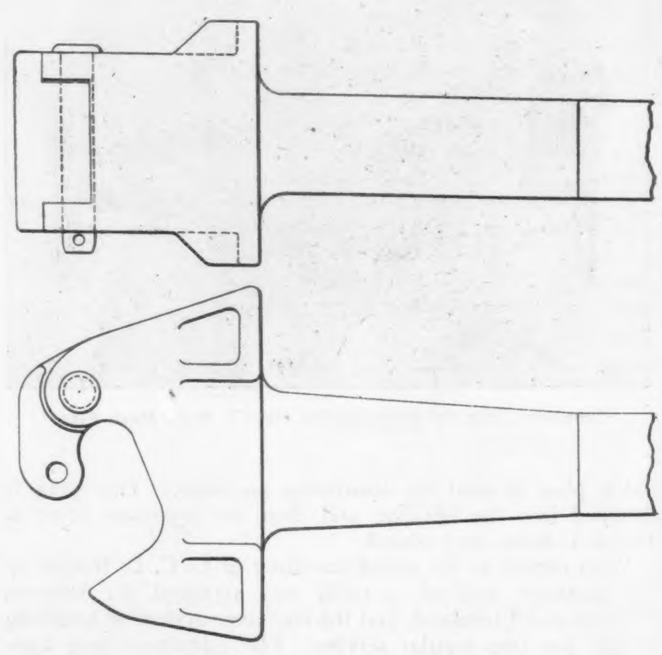


Fig. 3—Coupler with Shoulder All Around the Head

shape of a shoulder all around the shank as in Fig. 3. The latter arrangement, however, would not be efficient for impacts on curved tracks.

The material needed for forming such coupler horns would not be great because they are merely slight extensions to the wing webs which reinforce the present heads. Furthermore, this material could be taken from the shank which would be relieved from all solid impacts and so could be made lighter without decreasing the life of the coupler.

Such a change in coupler design would present less difficulty than was caused by the change from the 5 in. by 7 in. to the 6 in. by 8 in. coupler because the striking plate could be designed to suit the old type of horn as well as the new.

Motor and Trailer Car Driven by 120 h.p. Gasoline Motor

Motor Driven Rail Car with High Power Unit

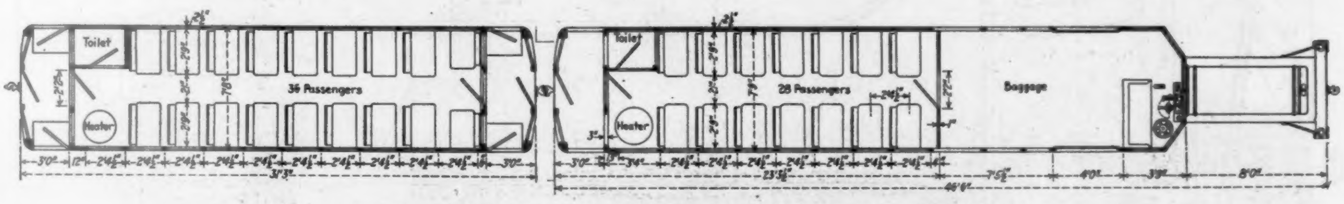
New Equipment for Maryland & Pennsylvania Has 120 Hp. Engine and Seats 76 Passengers

THE Maryland & Pennsylvania has recently received a passenger train, consisting of a gasoline motor coach and trailer, with a total seating capacity for 76 passengers, from the Russell Company, Kenosha, Wis. The motor coach is 37 ft. 6 in. in length over the end sills, with a 4-ft. 10-in. baggage compartment and a seating capacity of 28 in the passenger compartment. The trailer coach is 31 ft. 3 in. in length with seats for 40 passengers. Drop seats in the baggage compartment accommodate eight additional passengers. The motor coach is fitted with a 120-hp. motor and weighs 28,000 lb. The trailer weighs 19,000 lb., making a total for the train of 47,000 lb., or 691.2 lb. per seat, excluding the drop seats in the baggage compartment.

The cars are driven by a 5¾-in. by 7-in. six-cylinder Wisconsin gasoline motor, which weighs 1,275 lb. and develops approximately 120 hp. at 1,200 r. p. m. This motor, handling the motor car and trailer, averages 3.8 miles per gallon of gasoline. It is mounted on the underframe in front of the forward truck center and is equipped with an Eismann dual magneto ignition system, Stromberg carcarburetor and Leece-Neville generator and starting units. A separate 32-volt generator, with a 16-cell storage battery of 70 hours' capacity, furnishes power for the headlight and train lighting. Fuel is carried in two supply tanks with a total capacity of 52 gallons and is fed to the carburetor by the vacuum system, supplemented by air pressure.

The underframe consists of two 9-in. 25-lb. steel channels spaced 33 in. apart over the outside faces. The drive shaft is carried back through universal joints to the clutch and transmission, which are located under the middle of the underframe. Power for the air compressor and electric light generator are taken off this shaft, in the former case through a silent chain drive and in the latter through a belt. The transmission provides three speeds forward with a reduction of nearly five to one in low. The reverse gear is specially designed for railway service.

The driven shaft from the transmission passes into a drop gear case just back of the transmission, from this shaft the power is carried down to the drop shaft by a silent chain drive. The shafts inside the case carry two sets of gears. Those on the driving shaft are permanently keyed to the shaft while those on the drop shaft are connected to the shaft by a three position clutch. These gears provide speed ratios of 1.1 to 1 and .76 to 1 for each transmission speed, the purpose being to permit the motor to be operated at a speed lower than that provided by the normal ratio, when the car is traveling at high speed under conditions which do not require heavy duty from the motor.



Maximum Size Floor Plan of the Russell Motor and Trailer Cars

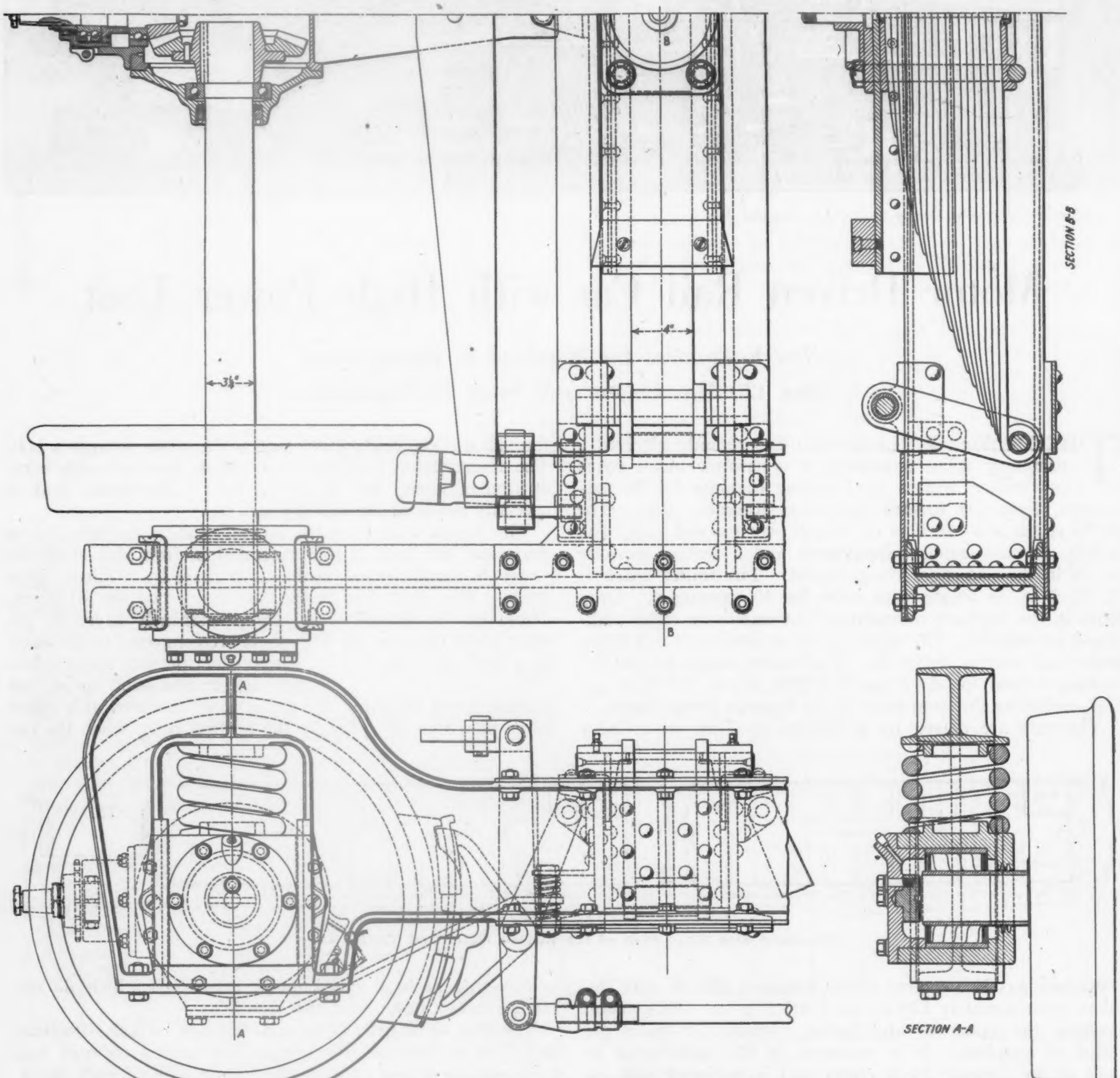
The drop shaft extends through the case in both directions and from it flexible drive shafts are carried forward and backward to a gear case on the inside axle of each truck. This gear case contains a bevel pinion, supported on ball bearings, which meshes with a bevel gear attached to the axle. The gear case is carried on the axle itself, but attached to it is a torsion arm which is spring supported on a bracket attached to the truck crossframe.

The trucks have a wheelbase of 4 ft. 8 in. They are built up of cast steel pedestal frames of 9-in. I section, connected by structural steel cross members of channel section, and weigh 3,750 lb. each. The side and cross members are joined by top and bottom gusset plates which are riveted to the channels and bolted to finished surfaces on the top and bottom of the sideframe castings. Davis cast steel wheels 24 in. in diameter are mounted on 3¼-in. solid steel axles. The out-

side journals are 3 in. in diameter and are fitted with ¼-in. steel sleeves and Hyatt roller bearings. The bearings are designed to carry a vehicle with a maximum weight of 40,000 lb. and run in oil. They are mounted in removable cages and are carried in a cast steel journal box on which the truck frames are supported through single coil springs. The truck bolster is made up of a 4-in. semi-elliptic spring the ends of which are supported by swing links from the truck cross frame. To the top of this spring a short channel for the support of the center and side bearings is attached by two U-bolts which also serve as the spring band.

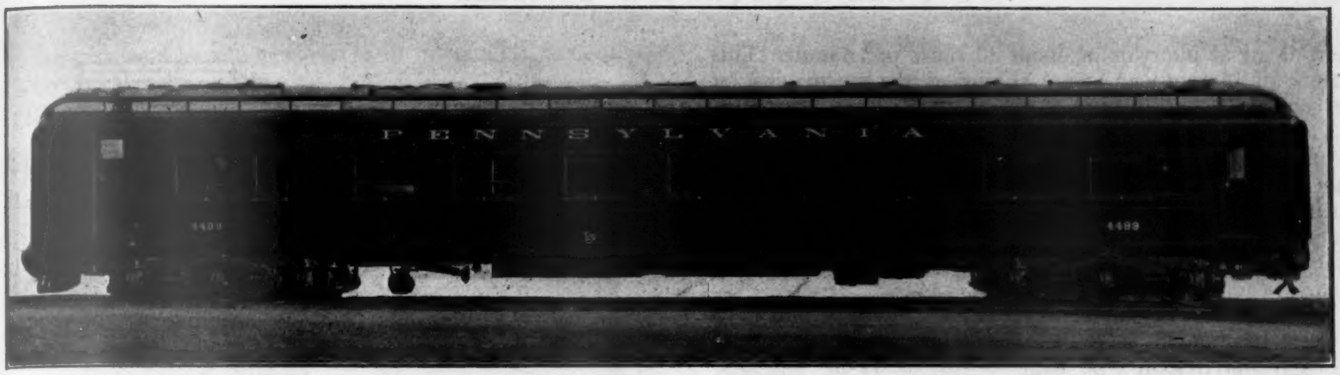
Except for the shorter baggage compartment and the location of the toilet and heater in the trailer car, the floor plans of the Maryland & Pennsylvania coaches are similar to those shown in the drawings, which are the arrangements of the builder's full size car bodies. The bodies of the Maryland & Pennsylvania cars are built separate from the underframes, to which they are securely bolted. The overall height is 11 ft. 4 in. above the rail and the floor is approximately 42 in. above the rail. The bodies are of wood frame construction with steel sheathing. The trailer of the Maryland & Pennsylvania train is fitted with a blind vestibule at the front end, in which the heater is located; the steps at the rear end of the motor car serve the front end of this car. The regular arrangement of the builder, however, provides for vestibule entrances at both ends of the trailer car and at the rear end of the motor car. The vestibules are fitted with trap doors.

Each car is fitted with a toilet and the trailer car carries a small Arco Ideal hot water heater. The motor car is heated by the motor exhaust, a portion of which may be diverted through metal ducts carried along the sides of the car just above the floor.



Motor Car Truck Developed by the Russell Company

The cars are fitted with Westinghouse self-equalizing automatic brakes. The brake heads and shoes are of the M. C. B. type and the couplers are Van Dorn vertical plane type, one-half M. C. B. size. The motor car is fitted with a pilot, an electric headlight, a bell, air operated whistle, and marker brackets.



Latest Type of Dining Car for the Pennsylvania

Pennsylvania System Dining Cars Built at Altoona

Attractive Interior Finish, Kitchen Equipment, and Cast-Steel Truck Side Frames Features of Design

TWENTY new steel dining cars for the Pennsylvania System have just been completed in the car shops at the company's Altoona works.

Structurally, these cars are the same as others now in service, having a center sill built up of two 18-in. channels with 1/2-in. by 24-in. top and bottom cover plates and four cantilevers, two attached to each side of the center sills, spaced 18 ft. 9 in. from the transverse center line of the car, supporting the superstructure. No bolsters are used.

The side truss below the window sills consists of a bottom angle 9/16 in. by 3 1/2 in. by 5 in., a belt rail of special section having an area of about 4 sq. in. and web plates 1/8 in. thick. The posts, of the cantilever type, are made of 1/8-in. pressed steel and extend from the bottom side angle to the

The general dimensions are as follows:

Length over buffers	82 ft. 3 1/8 in.
Distance between centers of trucks	56 ft. 3 in.
Distance between centers of crossbearers	37 ft. 6 in.
Width over sides	9 ft. 10 1/8 in.
Width over roof	9 ft. 11 1/2 in.
Width over upper deck	7 ft. 7 in.
Height from rail to center line of coupler	34 1/2 in.
Height from rail to top of paltform	50 in.
Height from rail to car floor	52 in.
Height from rail to eaves, lower deck	11 ft. 2 5/8 in.
Height from rail to eaves, upper deck	13 ft. 3 1/2 in.
Height from rail to top of roof	14 ft. 1/2 in.
Seating capacity	36 persons
Weight when fully equipped with ice, coal, water and supplies	160,000 lb.

Some of the fundamental features of the design are: area of center sill 50 sq. in.; ratio of ratio unit stress to end load 0.024; draft gear travel 2 3/4 in.; maximum coupler side motion travel, total, 18 in.; thickness of draft follower plate

Cast Steel Side Frames Reduce the Weight of the Truck and Decrease the Number of Parts

deck plate, the lower deck roof, 1/16 in. thick, being riveted directly to the posts. The deck plate is 1/8 in. thick and the upper deck roof sheets are 3/32 in. thick. The roof sheet joints are welded.

Vestibules have been omitted since passengers enter the dining cars only from adjoining cars. End protection against collapse is of the same strong construction used in all Pennsylvania System steel passenger equipment cars, which for non-vestibule cars consists of one 12-in. I-beam on each side of the doorway and two Z-bars, one 4 in. by 8.2 lb. and one 3 in. by 6.7 lb., at each corner, with pressed steel diagonals between corner and door posts. Standard diaphragms are attached to the I-beams.

2 1/4 in., section modulus all vertical end members 100, and for those either forming or adjacent to door posts 76.

The air brake is the Westinghouse type UC-1812, without the electro-pneumatic attachments, although this feature can be readily applied, as the wiring has been installed. The cars are heated with vapor, having a thermostatic control and may also be operated manually, the thermostat being located at the center of the car between windows.

The lighting effect in these cars is very satisfactory, semi-indirect lights being used, one over each pair of tables. Each fixture contains a 100-watt lamp, which makes a very efficient light. Between each pair of lamps is an electric fan with an air deflector or distributor, which produce a move-

ment of air at intervals of about 20 times per minute. This feature of intermittent breeze eliminates the steady gust of air common to many types of electric fans.

The draft gear is the Westinghouse type N-11 with attachments for cheek castings at least 25 per cent stronger than the A.R.A. requirements for freight cars. The cheek castings are riveted directly to the webs of the center sill channels and the tail yoke is cast steel with quadruple shear attachment to the stem, which has the latest A.R.A. type D head.

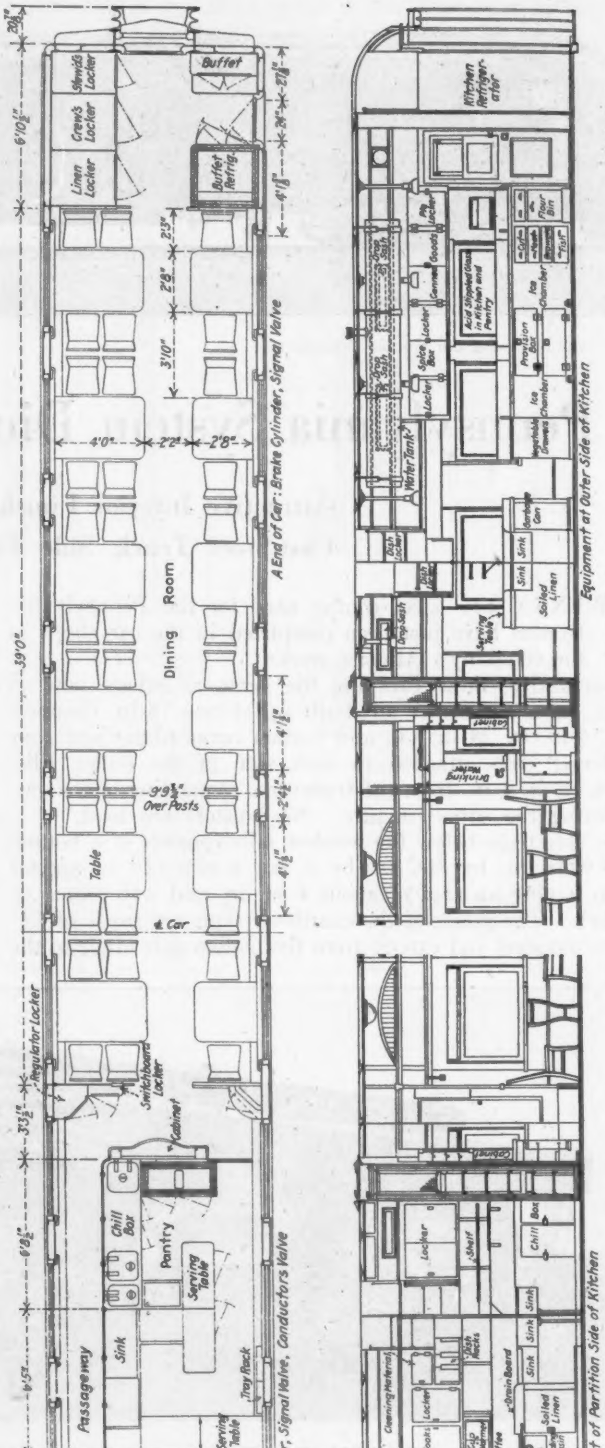
The trucks are of the six-wheel clasp brake type and have a wheel base of 11 ft. 0 in. The axles are of the special Pennsylvania System type with 5½-in. by 11-in. journals, and the wheels are rolled steel, 36 in. in diameter. The general scheme of the trucks is the same as used on all former Pennsylvania System cars, the bolster being of riveted plate construction, which has been exceedingly satisfactory

The Interior Is Finished in Olive Green

on previous cars. It was designed to flex readily in a horizontal plane, but is rigid against transverse and longitudinal strains.

The truck bolster is supported on sets of quadruple elliptic springs, one set under each end of each spring beam. The equalizers supporting the elliptic springs have one end hung from the truck frame, the other being attached to an inverted U-shaped equalizer and hanger combined, which rests on the helical spring located over the center journal box. These trucks have exactly the same characteristics as the two axle passenger trucks, but with increased wheel base and a third or floating axle placed between the other two. The helical springs are supported directly on the journal boxes, which in turn are guided as usual in pedestals. It will be noted that this arrangement results in having the least possible non-spring-supported weight and, therefore, the least possible kinetic effect on rails. The features which differ from the old trucks are the journal boxes and side frames.

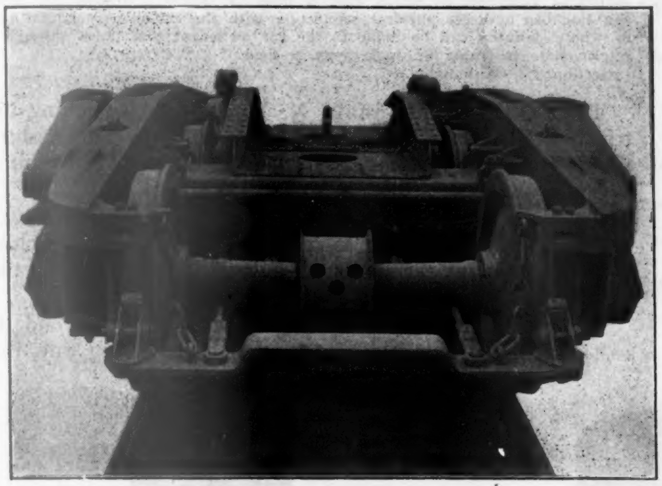
The journal boxes are of cast iron of a special mixture sometimes called semi-steel and also cylinder iron. The faces which bear against the pedestal legs are chilled and



Plan of Pennsylvania Diner and Elevation, Showing Kitchen Arrangement

the pedestals have renewable 3/8-in. plate steel wearing shoes riveted thereto.

The older trucks had side frames built up of channels, cast steel pedestals, spacing pieces, cross braces, etc. In the new truck all of these parts are combined into two cast steel frames, one on each side, connected flexibly by only two 2-in. transverse rods located respectively between the center and each end axle. Each frame can, therefore, readily adjust



End View of the Truck

itself, independent of the other frame, to meet track irregularities. Also, since the bolster is flexible in a horizontal plane, it in turn can adjust itself to the various positions taken by the side frames and, being rigid longitudinally, holds the side frames in correct transverse alinement. The cast-steel side frames were designed to be interchangeable with the old built-up side frames so that when repairs are necessary to old trucks the cast-steel frames, which weigh less than the built-up frames, can be substituted. The total weight of each truck is 23,000 lb.

The interior of these dining cars is arranged so that there is a large dining room, seating 36 persons. They are finished in plain mission style of architecture, the walls being painted a medium shade of olive green with striping of a darker shade of green edged with gold. The ceiling is cream color striped with dark green. The carpet and curtains are of a green shade. The color of the side walls is very unique and has been the subject of many complimentary remarks from passengers.

At one end of the dining room are located the linen lockers, crew's lockers and steward's lockers, while on the opposite side of the passageway there is a large refrigerator used by the steward for mineral waters, etc. A humidor is built into the refrigerator, but is made so that moisture from the refrigerator cannot enter the humidor. There is also at this end of the car a buffet for the use of the steward.

At the other end of the dining room the pantry and kitchen are located. These are arranged especially for quick service, the kitchen and pantry being in one without a partition between them as is usually the case, which permits the waiters to enter the kitchen and allows more freedom for the men.

The kitchen and pantry have a number of special features, such as a water filter for filtering all water used on the tables, separate coolers for milk, cheese, butter, meats and fish.

The refrigerators are of special design, being constructed as two separate steel boxes as nearly air tight as possible, one inside the other, with three layers of 1-in. cork board and two layers of paper between. The only connection between the outside and inside walls of the refrigerator is the aluminum door frame and this is separated from the steel plates by fibre insulation. The chill boxes in the pantry and kitchen are similarly constructed.

The table tops, sinks and splash boards are of monel metal, which, being rust proof, gives very satisfactory service for such parts.

Steel Coach for Great Indian Peninsula Railway

Steel construction has been used for the recent passenger cars built by Cammel, Laird & Co., Nottingham, England, for use in India. The first-class vestibuled coach shown is 67 ft. 10¾ in. long over end sills, 10 ft. wide and of 5 ft. 6 in. gage. The trucks, spaced on 48 ft. centers, are of the swing bolster type with coil springs under the bolster and semi-elliptic springs over the journal boxes. The wheels are of 43 in. diameter, the journals 4½ in. by 9 in., and the truck wheel base 10 ft. Screw couplers, side buffers and vacuum brakes with two 21-in. cylinders are in accordance with British practice. Roof ventilators, louvre ventilators over the windows and asbestos mill board insulation are provided on account of the tropical climate. The interior wood finish, the transverse seats, the electric lights and other fixtures were applied in India, the cars being dismantled and shipped in sections. Seats are of the longitudinal type. Side doors and vestibules provide for quick loading and inter-communication.

Car Inspectors and Foremen Hold Live Convention

Large Attendance for Discussion of New Rules of Interchange to Effect Common Understanding

A LARGE attendance of interchange inspectors, car foremen, and M. C. B. bill clerks marked the twenty-first annual convention of the Chief Interchange Car Inspectors' and Car Foremen's Association of America, which was held at the Hotel Sherman on November 9 and 10. In addition to the discussion of the changes in the interchange rules, which become effective January 1, 1923, the program included papers on the maintenance of tank cars, by S. F. Beasley, master car builder, Sinclair Refining Company; apprentices in the car department, by H. L. Shipman, engineer of tests, Atchison, Topeka & Santa Fe; the broad question of lubrication, by W. J. O'Connor, New York Central, and the loading of certain steel products, by W. R. Rogers, Youngstown, Ohio. The convention also listened to addresses by Joe Marshall, representing the freight claim division of the American Railway Association, and Charles M. Dillon, representing the Association of Railway Executives, and a talk on scheduling of equipment through repair shops, by E. H. Hall, Pere Marquette. As the new rules of interchange become effective on January 1, 1923, the discussion of the charges is included complete in this issue. The papers and addresses will appear in succeeding issues.

E. Pendleton
President

A. Armstrong
1st Vice President

W. T. Westall
2nd Vice President

Discussion of Changes in Interchange Rules

President Pendleton: It is the purpose to arrive at the uniform interpretation of the changes submitted by the Arbitration Committee, and not at this time to make any recommendation. The rules are not effective until January 1. No doubt the Executive Committee will meet the latter part of February or March, at which time any recommendations desired will be made for changes in the rules next year.

Rule 2

In order to eliminate conflict between Car Service Rules and Interchange Rule 2, it is recommended that the second paragraph and sections (i) and (j) of this rule be modified to read as follows:

PROPOSED FORM—Second Paragraph. Empty cars offered in interchange must be accepted if in safe condition and serviceable for some commodity that can be loaded in the car, the receiving road to be the judge.

Owners must receive their own cars, when offered home for repairs, at any point on their line, subject to the provisions of these rules.

Empty cars furnished on orders for specific lading must be in serviceable condition for such lading, the receiving road to be the judge.

Section (i)—A bad order foreign car delivered under load, if load is transferred or unloaded within switching district, may be returned to delivering line properly side-carded on both sides with a bad order transfer, or return when empty card, showing the defects for which the car was transferred or returned, in which case it must be accepted, unless the receiving line has a direct physical connection with the car owner at that point or where delivery can be made to the car owner at that point through an intermediate switching line, car ferry or float.

Section (j)—Eliminated.

T. J. O'Donnell (Buffalo, N. Y.): Is the switching district (section i) to be designated definitely by our Association? Supposing the car goes 25 miles outside the terminal, I would say that car ought to be taken back.

President Pendleton: It would make no difference what the distance was, as long as it was confined to the switching district. In many terminals we have switching districts that extend beyond 25 miles.

T. J. O'Donnell: If a car went seven miles beyond the switching district, would you compel the receiving line, that had to handle that car or unload it, to handle the car 500 miles to get rid of it, rather than return it to the road that gave the receiving line the load?

President Pendleton: I would say not.

T. S. Cheadle (Richmond, Va.): The old second paragraph specifies, "A foreign bad order car previously delivered under load must be received back by the delivering line, providing it has the same defects which existed when it was delivered under load, and is moving empty on its home route. Owners must receive their own cars, when offered home for repairs, at any point on their lines, subject to the provisions of these rules." I believe under the new ruling the car can be sent back for defects arising after the car has been delivered.

G. P. Zachritz (M., St. P. & S. S. M.): If we are not to deliver the cars back, in many cases how are we going to get rid of them? Suppose we may take a car outside of the Chicago switching district, unload it and save the delivering line the cost of transfer. According to this rule, unless it is inside the switching district, the delivering line does not have to take it back from us. Suppose the car belongs in the south, and we cannot make a direct connection. If we do not have a direct connection, either at Chicago or some other point, we must deliver that car back to Chicago to get rid of it. A strict interpretation of this rule would place us many times in the position of having to make a very heavy repair and we might have to haul the car 300 or 400 miles to put it in a shop where we could handle it.

A fair agreement would be that when a car comes back to the place where it was received the line that originally delivered it should accept it back, no matter what the defects are, so long as it is properly defect carded for any defects which we may have added to the car.

President Pendleton: We are not going to hang upon a strict interpretation of the rule. It is reciprocal and we are not going to have trouble.

The words "some commodity" in paragraph 2 will mean a great deal.

Mr. Zachritz: I think that means if the car can handle any commodity, it should be accepted.

Rule 3

The Committee recommends that a new paragraph be added to Section (b) as follows:

After January 1, 1924, cars equipped with couplers having riveted yoke without lugs will not be accepted in interchange.

REASON—The use of coupler yokes with pull depending entirely on the rivets should be prohibited.

A. Armstrong (Atlanta, Ga.): I move that the changes of the rules which are merely extensions of time, be not considered.

The motion was seconded and carried.

The Committee recommends that Section (f) be modified to read in accordance with proposed form shown below, the effective date being extended to January 1, 1923:

PROPOSED FORM—After January 1, 1923, *no refrigerator car* equipped with brine tanks will be accepted in interchange, unless provided with suitable device for retaining the brine between icing stations.

F. W. Trapnell (Kansas City, Mo.): I am of the opinion that we will have to have another extension on that.

Mr. Cheadle: You would not call January 1, 1923, an extension. How can a change be effected by that time? How are we going to tell when a car is equipped with brine tanks? I asked that question in 1907, and nobody has answered me yet.

President Pendleton: Isn't it a fact that some of the refrigerators that are equipped with brine tanks are so stenciled?

Mr. Cheadle: Some cars are equipped but not stenciled "equipped with brine tank." Some inspectors will say such a car has a brine tank and others will say it has not.

Mr. Zachritz: Isn't it a fact that you can tell the brine tank cars by the valves in the icebox?

T. J. O'Donnell: There are a large number of refrigerators that the owners tell us they are not going to equip with brine containers; there are a lot that do not need them; we have a lot of them stenciled.

Mr. Cheadle: There are cars that are not intended to be used for brine that are used for brine. It seems to me that the rules should say that brine cars not equipped with brine tanks should not be accepted.

Mr. Trapnell: I do not think we would be justified in refusing a load because it is not equipped with a brine tank. If we should spoil a car of fresh meat, we would hear from it. There should be an extension on that, because we have lots of cars that are not so equipped, that are used for fresh meat service.

The Committee recommends that the effective date of Section (g) be extended to January 1, 1923, and the section modified in accordance with proposed form shown below:

PROPOSED FORM—(g) After January 1, 1923, cars will not be accepted *from owners* unless stenciled, showing month and year built, or bearing a badge plate giving this information. Cars built prior to 1895 may be stenciled "Built prior to 1895," or bear a barge plate giving this information.

Mr. Zachritz: There is a very good idea in that change. You will note the car will not be received after January 1, 1923, from the owner. The committee should go further in all these exceptions, and, instead of using the term "not accepted in interchange," they should say, "not accepted from the owner." Then the originating line, that accepts that car from the owner is not penalized for having accepted it.

There are lots of instances in perishable freight service where we must violate these rules in order to get the freight going. If it is safe for the first line to handle, it is safe for the last line to handle.

B. F. Jamison (Southern): Does this paragraph mean that we would reject from the owner a loaded as well as an empty car that was not stenciled date built? Many cars are running today that have no date when built new stenciled on them. It would be impossible to stencil all those cars before January 1, 1923.

T. J. O'Donnell: The rule means a car, whether loaded or empty, but a man would not absolutely refuse it. Two years ago we held up about 700 cars and were told to let them go very quickly, when the rule became effective. Nobody would hold up a loaded car, but you should wire the owner.

Mr. Cheadle: Interpretation No. 6 under this rule says: "Cars, whether loaded or empty, must not be offered in interchange if not equipped with an efficient hand brake, per section (a); and United States Safety Appliances or United States Safety Appliances Standard, per section (k), in good order. Tank cars, whether loaded or empty, must comply with the requirements of sections (e) and (p). None of the other objections referred to would permit rejection of lading."

Mr. Zachritz: Our understanding is that we cannot refuse the lading, but we can ask for transfer orders for these conditions, which it says will not be accepted in interchange. We have to use our judgment; we have to violate the rules. All through the rules we have these exceptions which say, "will not be accepted in interchange." A great many cars are being refused and transfer orders asked for merely on these exceptions, and the railroad company should be relieved of this charge.

C. J. Wymer (C. & E. I.): The only loaded cars you can refuse are the ones mentioned in Rule 2. Neither do I believe that you can get a transfer order on a car that is not stenciled. You can find nothing in Car Service Rule 14 that would permit a transfer, because no one would say a car is defective because the date is not stenciled.

Mr. Straub: I do not think we should have any further discussion on (g) or (h); it says "from owners," and any head of a car department who is wide-awake will at once notify his inspectors at interchange points to telegraph at once to headquarters. In a few hours they will get the information they want, and the car will go on without any trouble.

Mr. Overton (Southern): Suppose the owner of a car not stenciled with the date built is on the Atlantic seaboard and the car is on the Pacific coast, the car goes to interchange and it is not stenciled the date built; what are you going to do with that car?

Mr. Straub: Interchange it until it gets back to the owner.

Mr. Jamison: I believe I am in order to ask for an interpretation on this rule, because I know it is going to be misunderstood. Section (h) following is also worded just exactly the same, that cars will not be accepted from owners. I move that under Rule 3, sections (g) and (h) apply only to empty cars offered in interchange by the owner.

G. Lynch (Cleveland, Ohio): I think the better way would be to ask for an extension of time. The time is too short to have these proposals complied with. Stenciling the date and year built is an unwise proposal for the reason that it is impossible to maintain, distinctly, the stencil on most equipment for any length of time, especially on steel equipment that may be a mill trade. It is very often scaled off from heat, and it will be an impossibility to maintain the date distinctly. I do not see the benefit derived from that information on the car to the foreign lines.

Mr. Hays (N. Y. C.): My belief is that the object of the time limit is to bring pressure to bear on the railroads

to meet the requirements the Arbitration Committee thinks necessary. When they issue a ruling, they place a certain date. The time limit is extended from year to year until the time has arrived when the date should be closed up. Evidently the Arbitration Committee believes the railroads have had ample time to carry out these requirements.

Now, a motion was made that cars should be accepted from the owner under load, but not empty. It is my understanding that ordinarily the owners' cars are moving home empty, and then he should take action to carry out these requirements before they are loaded and again sent off the line. In the event a car is received by the owner that his inspector does not catch and properly stencil and is reloaded and moving off his line, it is up to the receiving line to use good judgment as to whether it wants to reject the car or accept it. That policy can be arrived at between the two lines, and the rule will work no hardship.

The motion was lost.

T. J. O'Donnell: Did I understand Mr. Hays to say that would apply to loaded cars as well as empty?

Mr. Hays: My opinion is that this is something that should be mutually arranged between the receiving line and car owner. If they elect to accept the car it would be all right; if the receiving line did wish to reject a car, he would have that privilege, but he could not reject the load. He would have to accept the load and transfer at the expense of the car owner. The car owner then understands he is penalized for not living up to the requirements of this rule, which has been in effect for some time.

S. Skidmore (Big Four): I do not think we should encourage any transferring of cars, under such circumstances. We have had the claim department man here this morning telling us we should avoid, as much as possible, the transferring of cars. We are anticipating trouble that will not arise, except in a few cases. It is up to the lines to give all connection points these instructions. The stencils should be put on, it is only a few minutes' work, and to continue deferring this from year to year, you will never get them stenciled. I think that is the reason they have set the time limit at January 1.

Mr. Overton: For many years we have been trying to get all the equipment stenciled when built new, and we have arrived at a time when the thing should be closed out and stop those cars from rolling. If you are going to let cars leave the owner's lines they will keep on going. It may be a year or two before they get back, and we never will get our cars stenciled when built new.

Rule 4

The Committee recommends that the second paragraph of this rule be modified in accordance with proposed form shown below:

PROPOSED FORM—(second paragraph). Defect cards shall not be required for any slight damage (new or old) that of itself does not require repairs before reloading of car. Defect card shall not be required for raked or cornered sheathing, roof boards, fascia, bent or cornered end sills, if defects are old.

REASON—It is felt that the rewording of this rule will bring about the desired improvement in avoiding the issuance of unnecessary defect cards.

Mr. Hays: If it is not permissible to obtain a defect card for those items, suppose the car should arrive on the repair track for repairs to wheels, and the car foreman elects to repair them at the same time, what is the general understanding of the bill clerks? Would they accept a bill from the repairing line for the repairs to sheathing, roofing or end sill, when the billing repair card shows clearly that it was rather old?

W. M. Pyle (Southern Pacific): I would not be in favor of accepting a bill for such a repair. This would let down the gates for sharp practice. If the car is in such a condition that it is safe and serviceable to handle in interchange with this defect and it does not impair the loading of the car, then why not let the defect remain until the car reaches the owner and let him make the repairs? Then we do not open up the way for discussion.

Mr. Straub: A car can be raked and still remain in service a long time. It might get a commodity that is not damaged by the weather. For weeks or months the car owner might receive the revenue out of that car and he should bear the expense of any repairs made to a car that is raked, the billing repair card for which shows an old defect.

I, therefore, move that this Association go on record to that effect, that this should be a car owner's defect, so there would be no misunderstanding, in connection with the billing.

The motion was seconded.

E. H. Mattingley (B. & O.): Why should it be necessary to make a motion of this kind, when the rule says if it is so slight as not to require repairs it is not cardable; that in itself makes it an owner's defect.

T. J. O'Donnell: I do not think you can charge it to the owner. It is either a cardable repair or nothing.

Mr. Hays: When a car is placed on the repair track for some other defect, it would not be a good idea to let that car go with a few boards raked, simply because the road cannot collect for it. If we interpret the rule like that the foreman will probably let it go, and it will only be good for rough freight; after a while, you will have nothing but rough freight cars running. The object should be for all roads to put cars in good condition where they only require a few sheathing boards that are raked old.

A. Herbster (N. Y. C.): Interpretation No. 7, on page 65 of the 1921 code, reads: "If car is cornered, derailed, or sideswiped, and damage is not caused by any of the five conditions named in Section (d), is it handling company's responsibility?" And the answer is, "Yes." In the new rules Interpretation No. 7 is eliminated.

T. J. O'Donnell: Let us analyze this rule. The first part says: "Defect cards shall not be required for any slight damage (new or old) that of itself does not require repairs before reloading of car." That is definite. We would not card for it if it did not endanger loading of the car. If the first damage, when new, did not require repairs, why would the same identical damage, when old, require repairs?

Mr. Hays: I had in mind a car with raked sheathing boards that was shopped because it had an end sill or broken side sill broken in fair usage. Those sheathing boards had to come off; naturally, they would not let the old sheathing boards, all raked up, remain on. That is an exceptional case but it is the exception that causes the trouble.

Mr. Wymer: There are only two classes of defects: delivering line and owner's responsibility; there is no half way place, and when you take this defect out of the delivering line responsibility class it has no home unless you put it in the owner's responsibility class. It must have a home in one or the other.

President Pendleton: We do want to determine the proper interpretation of the rule. The motion is proper that it is the sense of this body that it is owner's responsibility.

The motion was carried.

Rule 9

The Committee recommends that the item showing information required on billing repair card under the heading "Air Brakes Cleaned," be modified in accordance with proposed form shown below:

PROPOSED FORM—R. & R. K-1 or K-2, convertible or non-convertible. Name of road and date of last previous cleaning.
Work performed, per Rule 60.

The Committee recommends that a new item be added under heading of "General Information," to be shown on billing repair card as follows:

Size of bolts and nuts.

REASON—In order to make it possible to check the weight of such material.

The Committee recommends the following interpretation of this rule:

Q. Is it necessary to specify dimensions of forgings and springs on billing repair card in addition to weight?

A. No.

REASON—This interpretation seems necessary on account of certain

railroads insisting that this information be furnished, although not specified in the Rules.

Mr. Hays: It is peculiar that the size of the bolts and nuts should be shown for the purpose of checking, when the interpretation says the size of the spring should not be shown. The ordinary bolt on a car weighs from two to four or five pounds; a 6-in. by 8-in. draft spring ordinarily weighs 35 lb. and an 8-in. by 8-in. draft spring 54 lb. If 54 lb. is charged on a billing repair card, unless the bill clerks are familiar with the type of equipment and type of draft gear, they must accept that charge without question. There is a difference of 19 lb. Possibly 6-in. by 8-in. is the standard and 8-in. by 8-in. was applied. There would be no means of checking that; and yet when it comes to a bolt, a size must be given so he can check.

Rule 12

The Committee recommends that the following be added as the second paragraph of Rule 12:

At points where it is impracticable for a railroad company to obtain joint evidence, the evidence of car owner shall be sufficient, provided it is furnished by a competent representative of the railroad company after actual inspection has been made by him.

REASON—The car owner should be afforded the means of establishing the existence of wrong repairs in the many instances when it is impracticable to secure joint evidence.

Mr. Jamison: What is the meaning of "impracticable" in the sense in which it is used here? Who is going to be considered a "competent representative"? At Memphis, Tenn., it is seven miles from our shop to the nearest car inspector, and it is not often we can induce him to come over and look at something. I would like to know whether it is the sense of this body that the rule would cover such situations as that.

Mr. Armstrong: Have you a car foreman at this point?

Mr. Jamison: We have.

Mr. Armstrong: He is your accredited representative.

President Pendleton: He has no other line.

Mr. Armstrong: He does not need any.

T. J. O'Donnell: Would it be impracticable to get the inspector where he is within seven miles of a car? I should think you would get the inspector.

Mr. Jamison: It is almost impossible. We have loaded cars on which we want joint evidence. It is one of the points where we get a lot of joint evidence.

Mr. O'Donnell: Your own inspector or foreman would be just as well on cars you do not want to hold up.

Mr. Jamison: Would you consider that an ordinary car inspector would be competent, where there were no car foremen?

President Pendleton: I would think so.

Rule 17

The Committee recommends that Section (e) of this rule be modified in accordance with proposed form shown below:

PROPOSED FORM—A. R. A. No. 2, or A. R. A. No. 2 plus brake beams may be used in repairs to all freight equipment cars equipped with non-A. R. A., A. R. A., No. 1, A. R. A. No. 2 or A. R. A. No. 2 plus brake beams; charges and credits to be on basis of beams applied and removed. A. R. A. No. 3 brake beam must be replaced in kind.

REASON—To permit the use of No. 2 or No. 2 plus brake beams as recommended by the committees on Brake Shoe and Brake Beam Equipment, Train Brake and Signal Equipment and Car Construction.

The Committee recommends that Interpretation No. 11 of Rule 17 be modified to read in accordance with the proposed form shown below:

PROPOSED FORM—Q. Owing to the great demand for equipment, it has become necessary in a number of cases to repair truck bolsters and pressed steel side frames by riveting patches, which makes a reasonably substantial job. Is it proper to bill car owner for this work?

A.—The patching of bolsters and truck side frames generally is not considered good practice. However, in the case of pressed or structural steel bolsters and pressed or structural steel side frames, patching of flat surfaces or tension side by riveting on plates, in a substantial manner, is permissible, and may be considered permanent repairs, provided this patching restores original strength of bolster or side frame.

In order to clarify the matter of exchanges of various types of triple valves, the Committee recommends the following interpretations to be added to this rule:

Q.—What types of triple valves are standard? What types convertible and what types non-convertible?

A.—The only A. R. A. standard triple valves are the K-1 and K-2. The only triple valves that are convertible to the "K" type are those having removable check valve case. Triple valves having check valves case cast integral with triple valve body and not removable are non-convertible to the "K" type.

Q.—Is it considered wrong repairs, to substitute one type of non-convertible triple valve for another non-convertible type?

A.—No. Provided car was built prior to January 1, 1919, and is stenciled, showing a non-convertible type valve as standard, or where car is not stenciled showing what type of valve is standard. Cars built after January 1, 1919, must have "K" type of triple valve applied.

Mr. Jamison: A question has arisen under that last clause, last question and answer. If I have a car built after January 1, 1919, carrying a non-convertible valve, will I be perpetuating improper repairs if I supply the same type of valves, the car not being stenciled?

Mr. Leonard: He would not be making wrong repairs.

Mr. Hays: In my opinion, wrong repairs would be made in such a case, because it says there very clearly, "Cars built after January 1, 1919, must have 'K' type of triple valve applied." If you find it necessary to give the triple valve attention where the car is not stenciled, then you would have to apply a "K" type valve, regardless of the type on the car, or you would be perpetuating wrong repairs.

Mr. Schroder (M. C.): Arbitration Case No. 1232 will cover the question. I think in this case you would be held responsible for wrong repairs.

Rule 58

The Committee recommends that the words "Cars offered in interchange with" in the first line of this rule be eliminated from the rule.

REASON—As these parts are frequently reclaimed for further use, they should be replaced at the expense of the handling line.

T. A. Eyman (E. J. & E.): If you lose an air hose or angle cock on your own line, you have the air hose and angle cock; but if you deliver the car, then the road that repairs it is out.

Mr. Zachritz: Mr. President, the way I interpret that rule, under Rule 58, cars offered in interchange with this material missing were carded—they were considered delivering line responsibility. Under the new rule, by removing the words "Cars offered in interchange with," it makes missing brake cylinders, reservoirs, angle cocks or air hose, each or all complete, delivering line responsibility, no matter where. If you lose any of these items and make the repair, you can charge that to profit and loss, the Committee says, because you would pick up that material and use it some other time. The handling line must assume responsibility.

Mr. Trapnell: If you deliver it with those things missing?

Mr. Zachritz: You would have to card it.

Mr. Cheadle: A member said there would be no necessity of a defect card. Some of these items do not constitute penalty defects. If the defect card is issued at a large number of points in the United States, where a line receiving the car is making repairs for the line delivering the car the bill clerk would possibly get those defect cards and will question them.

Mr. O'Donnell: What is the use of a defect card when you are doing the work jointly? Why don't you use the material? I should think you would arrange with the division officers to give you sufficient material to repair for both roads.

Mr. Cheadle: The management of the roads do not want to do that.

President Pendleton: As I understand the change in Rule 58, it makes the handling line responsible for replacing material lost on his line, and if he delivers it in interchange missing, it penalizes him for his failure to make repairs.

Rule 59

The Committee recommends that the words "Cars offered in interchange with" in the first line of this rule be eliminated from this rule.

REASON—As these items are frequently reclaimed for further use, they should be replaced at the expense of the handling line.

The Committee recommends the addition of a new paragraph to this rule under the bracket "Delivering company responsible," as follows:

Missing steam heat hose or air signal hose, complete, where cars are stenciled that they are so equipped.

REASON—It was felt that the car owner should be protected for such missing hose when car is so stenciled.

T. J. O'Donnell: I am wondering if the reinsertion of that provision was requested by many roads. We have had it out of the rules for about five years. There are only a few high class cars used in freight service. They go one way in passenger and express trains, and then return in freight, and you always have to watch the hose. Some inspectors say the cars were not stenciled and the owners says, "they were stenciled and we want the money." There are only three or four roads in the country that are following those things up closely. It is always a question of correspondence; we all have a pile of correspondence that high.

Mr. Cheadle: Mr. Lynch spoke of the cars going into steel plants and coming out with the stencils burned off. If the car passes one inspection point where the inspector is not familiar with it, it goes to another point where the inspector is familiar with it, and he will find a tail end of a letter on it and he will say it is stenciled. We have the same thing with steel wheels and air hose.

Mr. Lynch: Most car owners remove the steam hose during the summer months. Would we be obliged, during the months of the absence of the hose, to issue defect cards, if they are missing, removed by the owners, usually? It would complicate matters a great deal, in my opinion. The owner will accumulate a number of steam hose unless he removes the stenciling.

Mr. Schroder: In case the owner removes the hose, wouldn't he be carded in the first place, and that card removed when it came home?

President Pendleton: There is a possibility of the wrong road being penalized. If it is the practice of the owner to remove the hose, he should eliminate the stenciling, or stencil it that the hose was removed by the owner.

Mr. O'Donnell: Or report it to the division officers without issuing a card.

Mr. Zachritz: Or the line that accepted the car from the owner should accept it, owner's responsibility, because when he did not protect himself he has to protect the receiving line with a defect card when he is called on.

T. J. O'Donnell: It would be fine if they had in the rule: "For the steam hose, between the months of May and October, no cards are applied."

Mr. Armstrong: Mr. President, we have a mutual understanding in our gateway that defect cards will not be issued during the months of May to October.

J. J. Gainey (Cincinnati, Ohio): If the owner takes the hose off that car and does not take the stenciling off, he is bound to card that car when it goes through interchange, and it makes him responsible for it.

President Pendleton: But suppose he does not card it or the receiving line accepts it without a card; he would be penalized for not protecting himself.

Mr. Gainey: He should be.

Rule 60

The Committee recommends the addition of the following new paragraphs to this rule, to follow the present first paragraph, and read as follows:

Charge is not permissible for cleaning triple valve or cylinder unless the triple valve, cylinder, retaining valve, dirt collector (or pipe strainer) are all cleaned at same time.

If either the retaining valve or dirt collector (or pipe strainer) are cleaned, charge may be made therefor, even though cylinder and triple valve are not cleaned at same time. The cleaning of these items must be shown separately and bill rendered in accordance with Rule 111.

REASON—To insure a higher maintenance standard for retaining valves, dirt collectors and pipe strainers.

Mr. Jamison: If the car is not equipped with a dirt collector, what are you going to do? I am going to instruct our write-up men and regional record men to show on their original record, "Not equipped with a dirt collector."

It says, "dirt collector (or pipe strainer)," referring to the brake pipe strainer. You have no charge in Rule 111 for that. Is it the opinion of those present that we should use the same charges as for the dirt collector? It is practically the same job.

Mr. Cheadle: I would like to ask to which strainer you refer, the one at the center or the one at the triple valve?

Mr. Zachritz: The one at the triple valve, as we have always worked, is part of the repairs to the triple. I think the Committee should give us the price on this other strainer for next year, which I think would be the same as the cleaning of the dirt collector, as it is practically the same job.

Rule 70

The Committee recommends that the following note be added to this rule.

NOTE—Defect card should be attached to car at time and place wrong wheels are applied. Failure to do this obligates the road delivering car in interchange to issue its defect card. Before rendering bill on authority of such defect card, however, the car owners must investigate their records to ascertain, if possible, the road on which wrong wheels were applied. If by such investigation the owner fails to locate application, a statement to that effect must accompany bill on the defect card. In the event the application is located by car owner, settlement must be made by the road responsible, in which case the defect card issued under Rule 70 must be canceled. Subsequent receipt of repair card by owner after bill has been rendered on authority of defect card carries the same obligation.

REASON—It was felt by the Committee that car owners should be protected as far as possible against the substitution of cast iron wheels for wrought steel or cast steel wheels, and that the penalty should be assessed wherever possible against the line making wrong repairs, instead of against delivering line.

Mr. Zachritz: The bill clerks should be proud that the Arbitration Committee gave them the nice little job of hunting up this information.

Mr. Lynch: This note will make confusion worse confused. You will note that it is very mild toward the repairing line; it simply says that "the repairing line *should* attach a defect card," but that it is imperative on the owner that he "*must* investigate" to protect the line that failed utterly to properly protect itself. I think an addition to Rule 70 would be preferable to the note, reading: "The Company making such wrong repairs must place upon the car, at the time and place the wrong repairs are made, an M. C. B. defect card covering the wrong material used." This would make it compulsory on the part of the repairing line to attach defect card, and use the word "must" instead of "should," and write it out in capital letters, so they might see it. In Rule 87 there is an exception which relieves the repairing line from being responsible to the car owners, and I cannot understand why this hardship and inconvenience is imposed on the car owners because of the failure of the repairing line to apply a defect card.

Mr. Straub: This note is going to entail a great deal of work on record keeping and investigation. It would seem that the matter could be helped along a great deal when a defect card is issued at an interchange point for such wrong repairs, that defect card should show the wheel record of the wrong wheels so that you can have something to trace those particular wheels and who applied them. Sometimes the railway company's initials will be on the wheel and give you some clue.

F. C. Schultz (Chicago): I used to feel, or claim, that I could always locate the party who put in the wrong wheels—get his wife's name and his children's names—but I have gotten that out of my head. They are put in and not a word said about it. But in view of the fact that there are not many cases where the car owner is not billed for anything, this matter should be handled as wrong repairs.

Mr. Schroder: The road making wrong repairs should be penalized; but as far as the expression of the rule is concerned, I think it is understood by every car man that Rule 4 is forcible enough. Defect card must be applied when wrong repairs are made, but it is not being done and, as far as Rule 70 goes, we all know that the car should be carded. It is up to the American Railway Association to get the roads to pay more attention to issuing defect cards.

President Pendleton: In the past, all of the objectionable

features of the rules that we found we have recommended for change and have gotten a long ways with the Arbitration Committee with our recommendations. But this is not the time to make recommendations. We are going to discuss the application of the rules now and probably in the next 60 or 90 days the Executive Committee will have a session and that will be the proper time to make recommendations for changes.

Rule 91

The Committee recommends that Rule 91 be modified in accordance with the proposed form shown below:

PROPOSED FORM—Instructions for billing.

Bills may be rendered for work done under Rule 16, except in cases where owners are not responsible and the car bears no defect card covering the defects repaired, stating upon the bill the date and place where the repairs were made; the billing repair card or defect card to accompany the bill.

Billing repair cards returned for correction, or on account of exceptions, must not be defaced in any manner on the face of the card.

NOTE—The following provisions must be observed when rendering or correcting bills:

(a) Bills should not be rendered for amounts less than 25 cents in aggregate, but charges for items less than 25 cents may be held until they amount to that sum.

All bills should be rendered promptly. Bills rendered after one year from date of repairs may be declined. No bill should be rendered for repairs to cars after the time limit has expired, even though previous attempts have been made to ascertain proper ownership.

(b) No bills should be returned for correction on account of incorrect car numbers, but shall be passed for payment at once, and the alleged errors in car numbers brought to the attention of the company rendering same, within 60 days from date bill is passed for payment, but in no case exceeding six months after first receipt of bill.

The billing company shall furnish correct car reference, or shall issue, within 30 days, countercharge authority as per form shown on page 176. If it is alleged car was not on repairing road on date claimed, the car owner must show location of car on such date.

(c) No bills shall be returned for correction on account of other error or questionable charges unless the net amount involved exceeds 10 per cent of the total amount of bill, but shall be passed for payment at once and the alleged error brought to the attention of the billing company within 60 days from date bill is passed for payment, but in no case exceeding six months after first receipt of bill. The billing road must furnish proper explanation or shall issue within 30 days countercharge authority on form shown on page 176. If objections to bill do not amount to 25 cents in aggregate, no exception shall be taken; but bill shall be passed for payment as rendered.

REASON—There should be a time limit on exceptions on car repair bills where there has been an unusual delay in payment of same.

W. M. Pyle (Southern Pacific): Mr. President, the Railway Accounting Officers' Association has passed a mandatory rule effective January 1, 1923, that there shall be no bill rendered for an amount less than one dollar. They make an exception, however, to bills rendered by the American Railway Association, and make the recommendation that the bills shall be rendered for amounts not less than 50 cents. While these proposed revisions have already been adopted and will be incorporated in the rules as of January 1, 1923, it would appear that some consideration and thought should be given them.

I recently received a bill from a certain railroad for four cents. Now, it costs us four cents postage, two cents down and two cents back, to get that bill approved by our operating officers. Then the company used two cents more to mail the voucher, besides the clerical work in preparing it. So I returned it to them and asked them to cancel it, in accordance with the rules. We should take into consideration the recommendations of the Railroad Accounting Officers' Association, and a limit of the minimum of 50 cents for bills should be adopted.

Topical Discussions

In the course of the discussion of the changes in the interchange rules several questions not bearing directly on the changes were raised and discussed. In order not to break the continuity of the discussion of these rules, these questions have been grouped together below.

Mr. O'Donnell: I wrote Mr. Hawthorne, secretary of the mechanical division, and asked him if it would not be agreeable to put the number of the rules on the margin of the page instead of between the lines. Mr. Hawthorne replied immediately, and stated that the set up for this reprint is retained until the whole book is changed; they only reset the changes and the new matter. But he said that if at any time in the future the type was all reset again, he thought the suggestion was a good one and would be adopted by the Arbitration Committee.

Mr. Straub: It is only within the last year that they omitted the number from the top of the page, and any busy car foreman knows how difficult it is to hunt through his book of rules.

President Pendleton: The suggestion is a very good one and, no doubt, will be taken care of at the time the reprint is made.

Perpetuation of Wrong Repairs

W. M. Pyle (Southern Pacific): I am called upon at the present time to issue a defect card for a wrong triple. On June 16, 1921, we had a car in our Phoenix, Arizona, shops for light repairs, and at that time the triple was changed and a wrong triple applied, and although the car was stenciled "cylinder and triple oiled," with the date, June 21, 1921, still there was no repair card made for this work; in fact, there was not any work written up for the light repairs done on the car, through an oversight. My attention was called to it after June 23, 1922, when the car was repaired by the Southern; the air was cleaned and a standard triple applied. The Southern billed the owners for it. The owners come back now and ask for a defect card to cover the wrong triple.

Now, the rules provide that wrong repairs shall be detected within a certain time limit after the car is received on the owner's rails. We gave this car to the owners the day after it was repaired. That car bore our stamp showing that we made this wrong repair. Now, do you think that we should give the defect card for the wrong repairs? I do.

President Pendleton: There is no question but what you should.

Mr. Leonard (B. & O. C. T.): I think you should not issue a defect card for the wrong repairs. The owner did not take the opportunity when he had the car on the line the first time. He let it go to another connection and they made the proper repairs.

G. P. Zachritz (Soo Line): Is there any time limit as to when the repair card of the repairing line shall act as a joint evidence against the former repairing line? I know of none. We have had cases where the owner had the car in his possession in time to have taken advantage of the time limit, but he did not do so; yet if the repair card was furnished by the repairing line to him as joint evidence, I fail to find any limit on that in the rules and consequently you are in for a defect card.

Accounting for Salvage on Rebuilt Cars

T. A. Byman (E. J. & E.): We are putting some new underframes under cars, building the body new, using the same repaired air brakes and using the trucks.

The accounting department, through the Government's interpretations, claims that if you renew over 51 per cent of this car it must go into capital account. On the other hand, if it is less than that, it goes into general repairs of the car. The rules have always stated that if a car is unfortunate enough to be destroyed on another line, and you have your second-hand trucks, it must go back to the old date the truck was built, rather than the body of the car.

In building these cars there was good second-hand material available from the car that was torn down, but instead of using this material in the new car, we used it in the repair of other cars. Is the car rebuilt entitled to this second-hand material? There is a difference of opinion on that matter, and I was wondering if any of you gentlemen had any experience on this matter.

E. H. Hall (Pere Marquette): I would state, Mr. President, that regardless of the rules of interchange, you have to follow the accounting rules laid down by the Interstate Commerce Commission. Those rules read to the effect that when the repairs exceed a major portion of the cost to replace in kind any unif of equipment, it shall be retired from your accounts and taken into your other accounts as new equipment.

Mr. Eyman: The only point is whether we can credit that car with the second-hand parts, for the reason we are using it on other cars. They say we cannot credit that second-hand material to the car we take it off of, unless we put it back on that car.

Mr. Hall: You scrap it.

Mr. Eyman: Yes, but it is not scrapped.

Mr. Hall: But you are taking it back as new material.

Electric Lights for Car Inspectors

Thomas O'Donnell (Bureau of Explosives): I was wondering if you had considered the recommendation to your officials of the use of electric lights in the yards instead of the present oil lights for inspection, particularly on dangerous commodities that we are up against more and more every day.

T. J. O'Donnell (Buffalo): My experience is that you are always safe with the present light if you have your wits with you, but the inspectors from time to time bring the subject up, and I am wondering if it would not be a topic that our officials could consider. Of course, if you use electric flashlights it would be an expense and might not be agreeable.

Mr. Lynch: Mr. President, I believe that many lines furnish inspectors with those flashlights for the inspection of tank cars, especially. I do not know whether it would be a good idea to use them exclusively or not; it would be rather expensive and they would be hard to get around with, because the battery would have to be so much larger.

Thomas O'Donnell (Bureau of Explosives): For some years we have been agitating the use of the electric lamp along with nearly all safety departments of the railroads. Recently, I made a survey in the St. Louis terminals, and I find that no road there has adopted the battery lamp, but many individual switchmen and yard men have them and are supplying the batteries themselves. After they become accumstomed to this lamp they will not use the oil lamp.

Recently the good points of the electric lamp were brought to my attention in a wreck involving several tank cars of gasoline, out on a single track, and we did not have any flashlight to work with. There isn't any oil lamp that can be considered as anything but an open flame light, which it is absolutely unsafe to bring anywhere near leaking tank cars because the vapor will come to the light. There is an impression among the inspectors in some places that a hood over the light renders it safe, but, of course, it does not, because if enough oxygen can enter to keep the light burning, the inflammable vapors can enter and they will flash back to the leak.

I think this body might well go on record as recommending some action be taken on eliminating the open flame lamp.

E. H. Mattingley (B. & O.): I think that question was talked of considerably at the Montreal convention (1920), and it was recommended that this Association or its members recommend to their railroads that the electric light be adopted as a standard car inspector's lamp.

A. Herbster (N. Y. C.): On the New York Central we have had electric lamps for what we call gasoline points for three or four years, and they are working out very satisfactorily. That, of course, only has reference to points where we handle gasoline as an everyday commodity. Additional lamps are also carried in the wrecking outfits, but they have not been adopted universally.

Mr. Cheadle: At the Montreal meeting the motion was that we take it up with their officers to see that lights were provided the inspectors to make inspection of tank cars, or in case of leaking tank cars. There was no action taken for placing electric lamps in the hands of inspectors for all classes of inspection.

President Pendleton: How many members have taken the matter up with your superiors, and how far have you gotten with it?

T. J. O'Donnell (Buffalo): I gave the data to our executive committee.

Mr. Cheadle: On our line electric lamps were placed with the inspectors for use in case of a leaking tank car or anything of that kind. Several inspectors have purchased various kinds of electric lights. Some of them have told me they are hard to use for the reason that they often suddenly go out and they have to go back to the point where they keep the batteries to replace it.

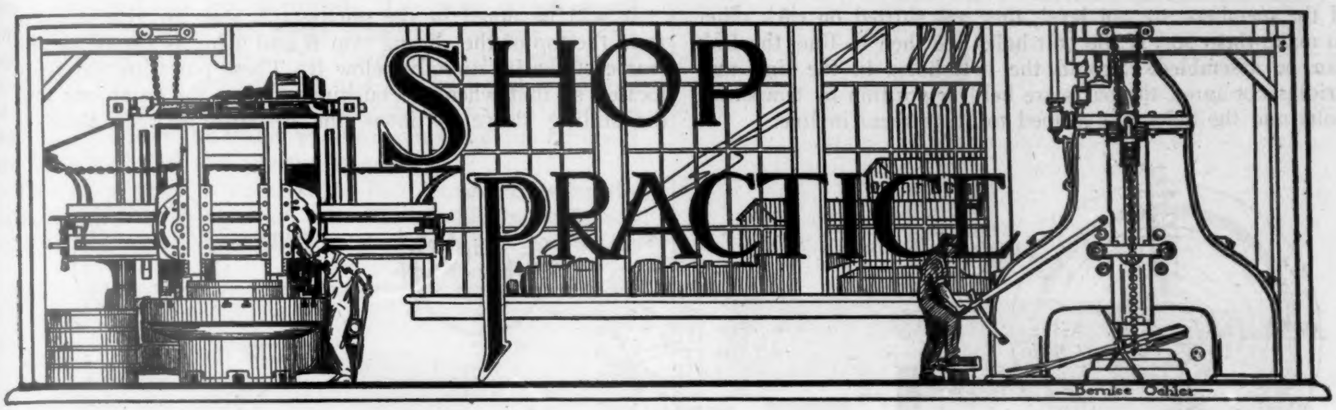
Thomas O'Donnell (Bureau of Explosives): There is scarcely a man in this room who does not admit that it is necessary to have this electric light. Colonel Dunn, in every speech he has ever made along safety lines, has recommended it; but there isn't any body of men in the business who are as practical along that line as you are here, and your recommendation would be the weightiest thing we can have behind it.

Election of Officers

In addition to the election of officers the association also voted to have the proceedings published in book form for wide distribution among the members and other railway officers and men interested in the work of the organization. The proceedings will be published by Bruce V. Crandall, without expense to the association.

At the closing session on November 10, the following officers were elected for the coming year: A. Armstrong, Atlanta, Ga., president; W. Westall, New York Central, first vice-president; C. M. Hitch, Baltimore & Ohio, second vice-president, and W. P. Elliott, Terminal Railroad Association of St. Louis, secretary-treasurer. The following new members were elected to the executive committee: W. M. Pyle, Southern Pacific of Mexico; B. F. Jamison, Southern; A. S. Sternberg, Belt Railway of Chicago, and J. A. Roberts, Chesapeake & Ohio. E. Pendleton (Chicago & Alton), the retiring president, becomes chairman of the executive committee, and the terms of J. E. Gordon (New York, Chicago & St. Louis), A. Herbster (New York Central) and W. H. Sherman (Grand Trunk) continue through the next year.

Mallet Locomotive on the Wheeling & Lake Erie



Methods of Repairing Walschaert Valve Gear Links

Operations Systematized to Permit Quantity Production of Parts; Jigs Insure Accuracy

THE links used on Walschaert valve gears are not easily handled in ordinary machines; consequently, when repairs are made, the parts are usually fitted on the bench with whatever equipment is available. In many cases little attention is given to the alinement of the trunnions with the result that the bearings bind unless they are given excessive clearance. Other errors are also likely to occur in fitting the parts. At one large locomotive repair shop an excellent method of repairing links has been developed, which insures accuracy and facilitates the work, as described and illustrated below.

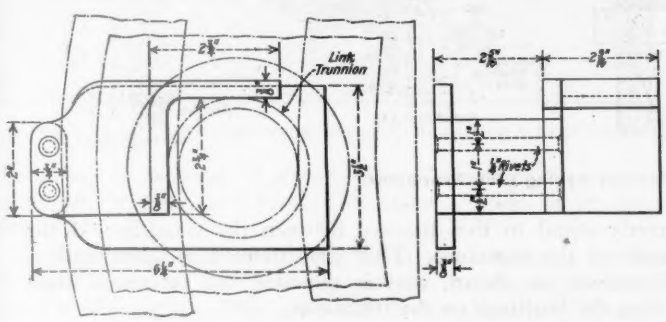


Fig. 1—Gage for Checking Alinement of Link Trunnions

When links are received in the shop, they are inspected to determine what repairs are needed. It is almost always necessary to grind the faces of the link slot and this is done on the usual type of vertical spindle radius link grinder. The trunnion bushings when defective are removed and replaced. The trunnions are checked with the gage shown in Fig. 1 to determine whether they are exactly at right angles with the sides of the link. If they are not alined accurately, or if they are not of the same diameter for their entire length, the trunnions are trued up with the hollow adjustable mill shown in Figs. 2 and 3.

In order to check the accuracy of trunnions and insure their being in line, as well as at right angles to the link, they are assembled in the fixture shown in Fig. 4. The lower member *A* is bored and carries a sliding sleeve. The inside of this sleeve is tapered at the upper end to fit the segmental bushings shown on the table in front of the fixture. The vertical movement of the sleeve is controlled by the lower hand wheel *C*. The ram *B*, which is in perfect alinement with the lower sleeve, works freely in the frame and is vertically controlled through a rack and pinion by handle *F*. A sliding sleeve, similar to the lower sleeve, is located in this ram which is controlled by upper hand wheel *C'*. The tapered outer surfaces of the segmental bushings fit either of the two sleeves, the bore of the different bushings being suitable for varying diameters of trunnions.

The fixture is set up so that the ram *B* and lower sleeve are plumb with each other. The weight of the link when assembling is borne by the vertically adjustable arms *EE*.

The method of setting up and adjusting a link and bridles is as follows: Suitable bushings are selected and placed on each trunnion. The lower bridle is placed in the lower support *A*. The link is placed on arms *EE* and vertically adjusted to a line with the bridle, the upper bridle is then applied and all members are loosely bolted. The ram *B* is lowered until the collars of the bushings are held tight, when the ram is held from movement by a set screw not shown, located on opposite side of the fixture. The hand wheels *CC'* are adjusted, thus centering the segmental bushings on the trunnions and in the fixture. This in turn brings the two trunnions in line.

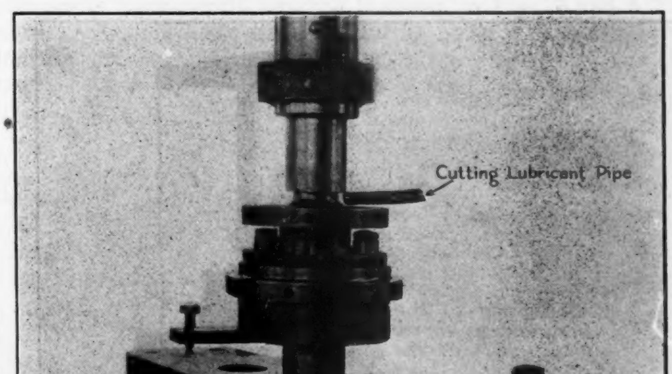


Fig. 2—Truing Link Trunnion with Hollow Adjustable Mill

In order to insure the link being square with the trunnion, a spirit level is placed on the upper surface of the link and,

if the members are not level, they are shifted on each other to make them so. If the bolt holes are then in line, the link can be assembled. Should the bolt holes in the link and bridles not agree, the parts are held in position by temporary bolts and the holes are reamed to bring them in line.

It will be noted in the photograph that an arm projects from the top of the sliding ram B and a lug is placed on the frame of the jig directly below it. These parts are carefully located so that when the bushings are on the trunnions and the sliding sleeve is down, the distance between them is

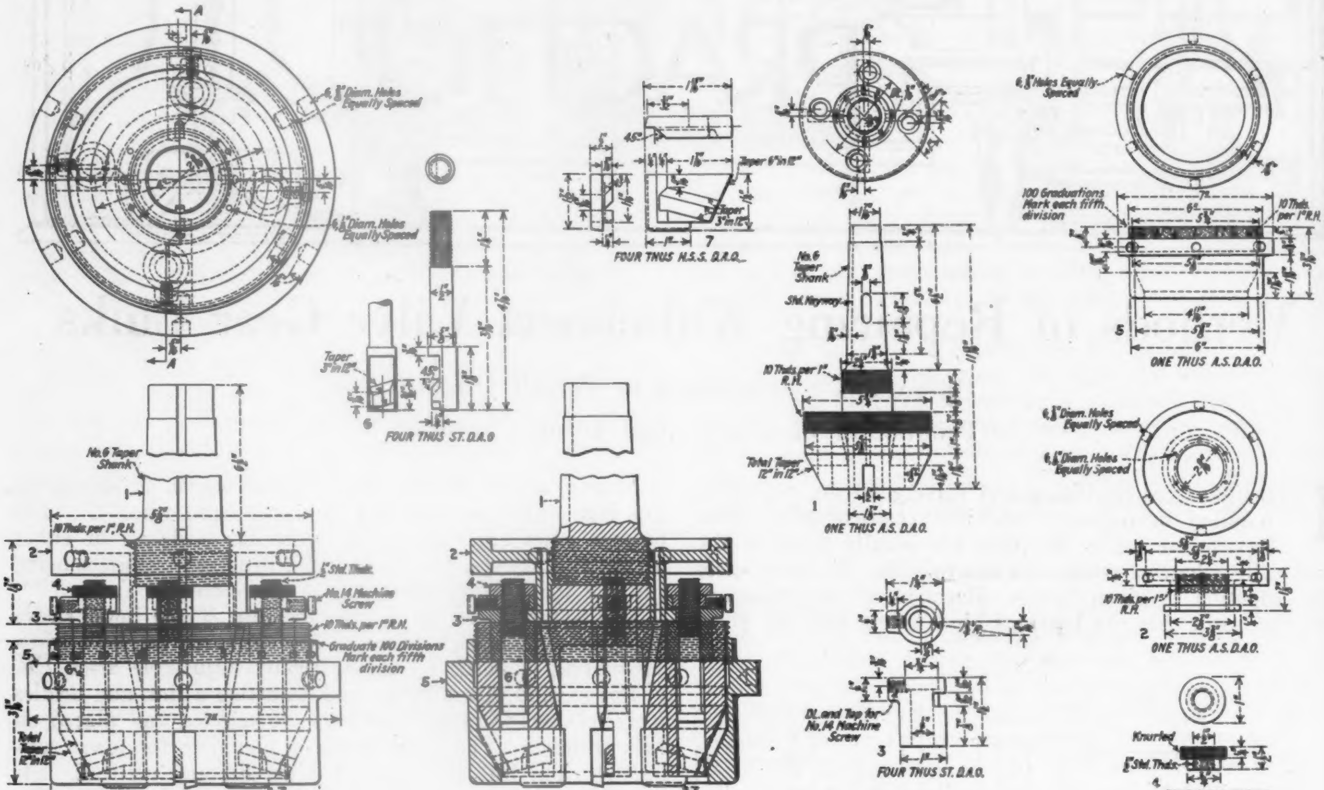


Fig. 3—Details of Hollow Adjustable Mill for Truing Link Trunnions

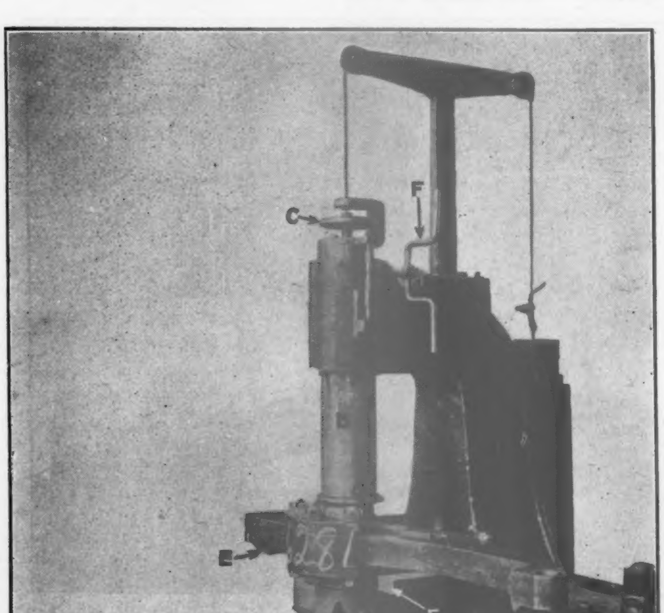


Fig. 4—Fixture for Assembling Links and Trunnions

exactly equal to the distance between the shoulders at the inside of the trunnions. This measurement is taken with a micrometer as shown, and is recorded for reference when fitting the bushings on the trunnions.

The bushings on the trunnions are fitted to the bushings in the link supports. The bushings for these brackets, which are of the form shown at A in Fig. 5, are blanked out and

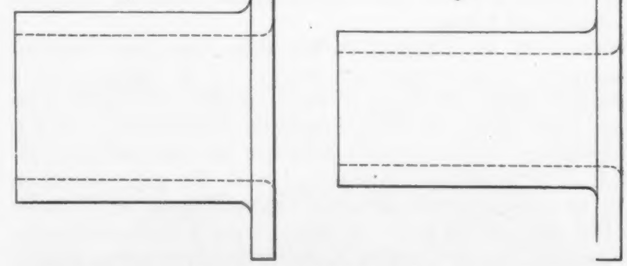


Fig. 5—Bushings for Link Supports and Trunnions

reamed on automatic machines and are then carbonized but not hardened. The bores of the bushings are then ground to a standard size. Before applying the bushings, they are turned outside to a press fit in the link supports; the flanges are faced to restore the original dimensions between them; they are hardened and pressed in, and the distance between the inside faces checked.

The trunnion bushings are also blanked out on automatic machines, the outside diameter being ground to a standard size to fit the bushings for the brackets, after which they

are carbonized but not hardened. The bore is left small and the thickness of the flange somewhat oversize to compensate for irregularities. The diameter of the trunnion is measured with the micrometers and the bushings are bored to make a press fit and the thickness of flanges is made suitable to restore the standard dimensions and the bushings are then hardened and pressed in place.

This completes the work on the link, except renewing the bushing for the eccentric rod pin. These bushings are made in quantity, bored, case-hardened and internally ground to

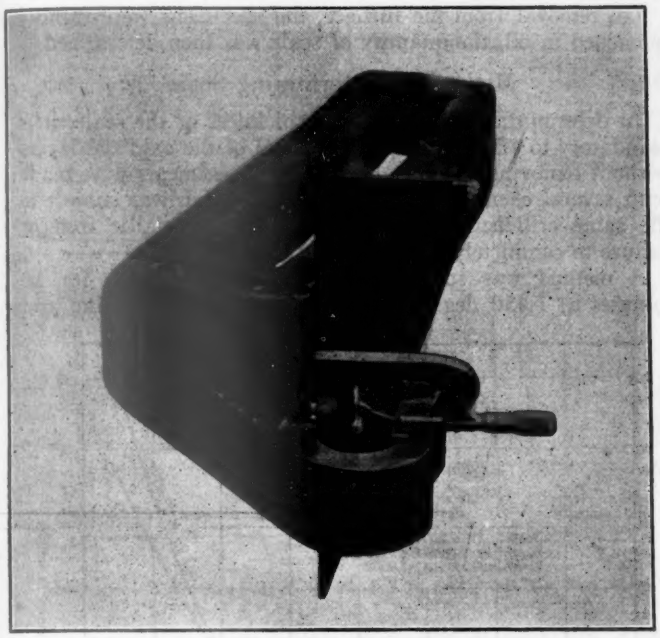


Fig. 6—Gage for Checking Roundness, and Measuring Size of Holes

grade sizes to fit standard sizes of pins, the outside diameters being left oversize and ground to make a press fit in the holes.

In measuring the sizes of these holes, two interesting types of gages are used. The first type, shown in Fig. 6, consists of a triangular plate with two accurate straight edges. Along

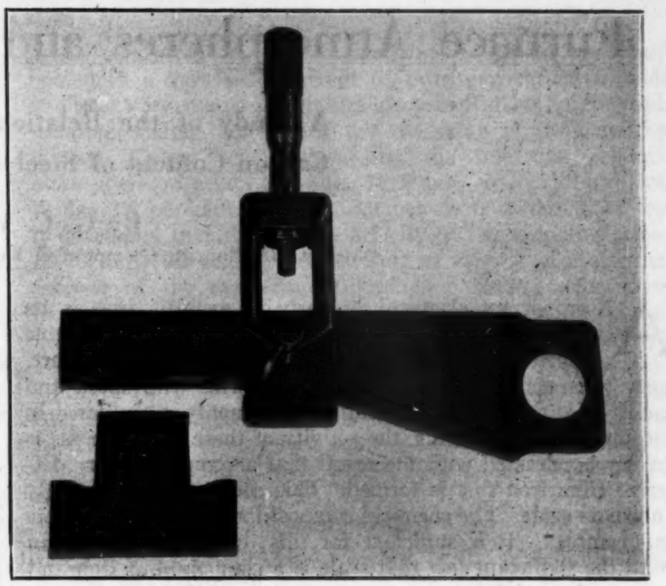


Fig. 7—Special Gage with Micrometer Attachment

one edge is a rib which holds a slider that can be clamped at any position along the side. The outside straight edge of the slider is parallel to the opposite side of the plate. By moving the slider, the distance between these parallel edges can be varied over a wide range.

In using the gage, it is inserted in the hole as shown, the slider being moved along the edge until the gage fits the hole. The slider is then clamped and the gage rotated to see whether the hole is round and not tapered. If any irregularity is found, the hole is ground on an internal planetary grinder. If the hole is true, the diameter is measured with a micrometer as shown in Fig. 6, or the slider may be clamped and the dimension taken after the gage is removed from the hole. A similar tool which has the micrometer permanently attached is shown in Figs. 7 and 8, being used principally when measuring holes at a distance from the machines where the bushings are ground. In this case the inspector reads and makes a memorandum of the sizes.

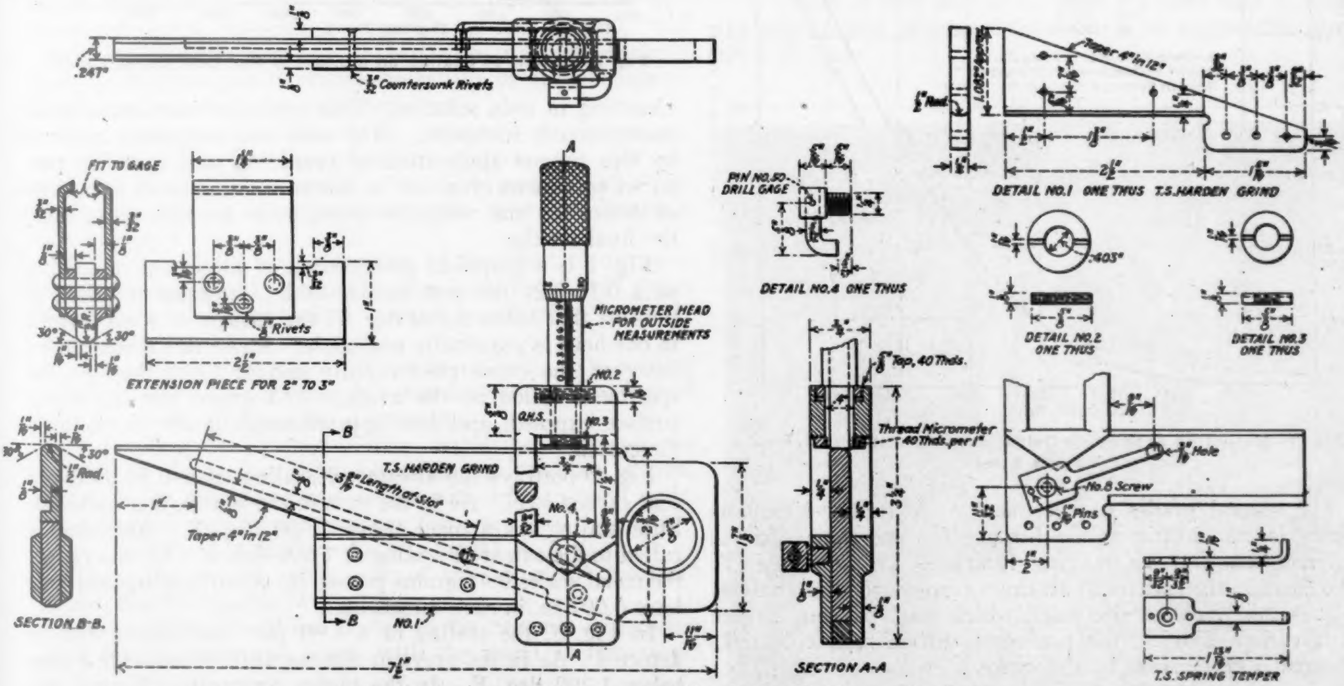


Fig. 8—Assembled View and Details of Special Micrometer Gage

Furnace Atmospheres and the Formation of Scale*

A Study of the Relation of Scale Formation to Carbon Content of Steel and Furnace Atmosphere

By G. C. McCormick

Assistant Metallurgist, Crompton & Knowles Loom Works, Worcester, Mass.

An important chemical property of metallic iron is its tendency to combine with oxygen. Under favorable conditions of atmospheric humidity and temperature, rust, a compound of iron and oxygen, forms with speed and facility. At the higher temperatures, commonly encountered in forging and heat treating, the activity of these two elements is greatly accelerated with the result that a compound very different from iron rust is formed. This compound is generally known as scale. The chemical composition of scale is variable and complex. It is sufficient for this discussion to bear in mind the signficant fact that scale is a compound of iron and oxygen, formed in the temperature ranges of thermal treatment. This experimental work was conducted for the purpose of determining, first, the temperature at which scale begins to form, and second, the extent of scaling at common heat treating temperatures.

Procedure

A series of blocks were cut from low, medium and high carbon steels. Special attention was devoted to the cutting of the blocks in order that they should possess as nearly as possible the same dimensions and weight. The specimens were polished on a fine wheel, cyanided for 10 min. at 1,450 deg. F., quenched in water and cleansed in a hot soda solution. This procedure served to remove the mill scale, rust, or grease, with which the surface of the bar stock may have been coated. The sample pieces were then calipered and weighed.

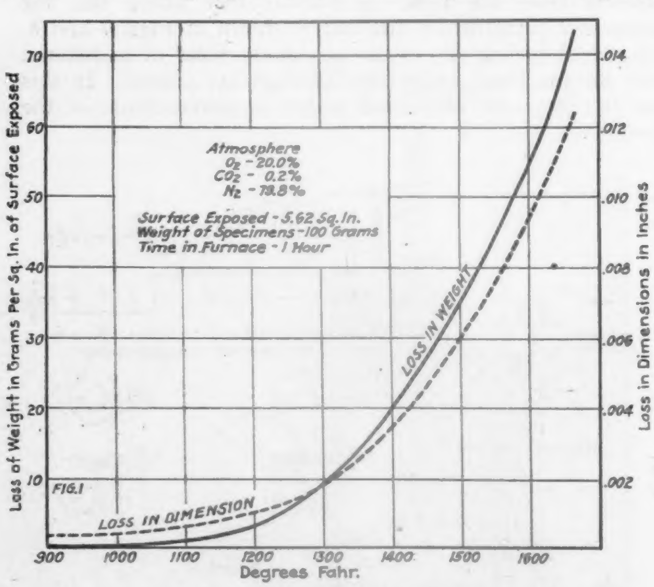


Fig. 1—Extent of Scaling or Oxidation on a 0.12-0.20 Per Cent Carbon Steel

The several grades of specimens were heated simultaneously in an electric muffle furnace for one hour each at different temperatures ranging from 900 to 1,700 deg. F. The gases in the furnace at all times corresponded in analysis to the atmosphere of the room, which was: oxygen, 20 per cent; carbon dioxide, 0.2 per cent; carbon monoxide, nil; nitrogen, 79.8 per cent by difference.

* Abstract of a paper presented before the Detroit Convention of the American Society for Steel Treating.

On removal from the furnace, the specimens were rapidly quenched in oil, the quantity of scale was then determined.

Method of Determining Scale

In determining the weight and thickness of the scale, it is mandatory to effect a complete removal of the oxidized layers without removing any metallic iron. Experiments were made with several chemical methods, each of which was subject to the same criticisms—excessive removal of metallic iron or failure to completely remove the oxides.

A method was suggested of heating in cyanide for 10 minutes at 1,450 deg. F., followed by water quenching and

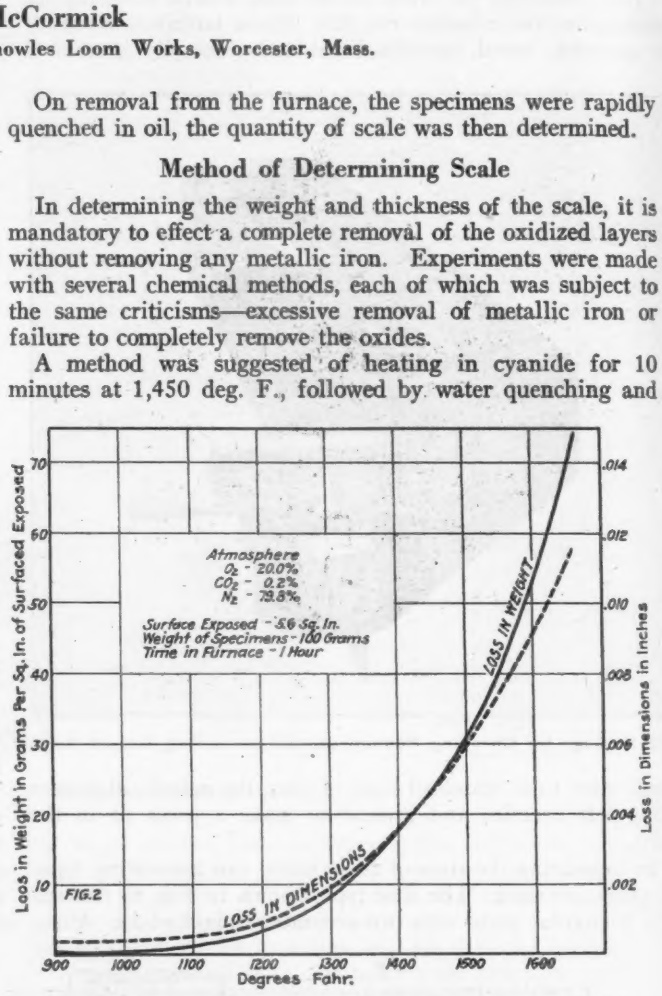


Fig. 2—Extent of Scaling on a 0.50-0.60 Per Cent Carbon Steel

cleansing in soda solution. This procedure was found to be conspicuously successful. The scale was completely removed by this unique application of cyaniding and specially prepared specimens cyanided in this manner, showed variations of dimension and weight so small as to have no effect upon the final results.

Fig. 1 is a graphical presentation of the extent of scaling on a 0.10-0.20 per cent carbon steel. Attention is called to the fact that below 1,200 deg. F. the amount of scale formed in one hour is practically negligible. Above this temperature, however, the curve rises rapidly and at 1,600 deg. F. the specimens scaled on the average 0.55 grams per sq. in. of surface exposed, and lost approximately 0.009 in. in each dimension.

Fig. 2 portrays the amount of scaling on a 0.50-0.60 per cent carbon steel. As in the case of the low carbon material, little scaling takes place below 1,200 deg. F. Attention is called to the extent of scaling at 1,600 deg. F. In this range, the metal scales 0.45 grams per sq. in. of surface exposed and loses 0.007 in. in each dimension.

In Fig. 3, the scaling of a 1.00 per cent carbon steel is depicted. As in the previous figures, little or no scale forms below 1,200 deg. F. In the higher temperature ranges, for example, at 1,600 deg. F., the steel loses 0.40 grams in

weight for every square inch of surface exposed and suffers a decrease of 0.006 in. in each dimension.

Summary of Scale Formation

From a study of these curves, it is evident that:

1. Little or no scale forms below 1,200 deg. F.
2. The amount of scale formed under the given conditions varies inversely with the carbon content of the steel.
3. The formation of scale increases rapidly with the rise in temperature above 1,200 deg. F. and at 1,600 deg. F. may be fittingly described as excessive.

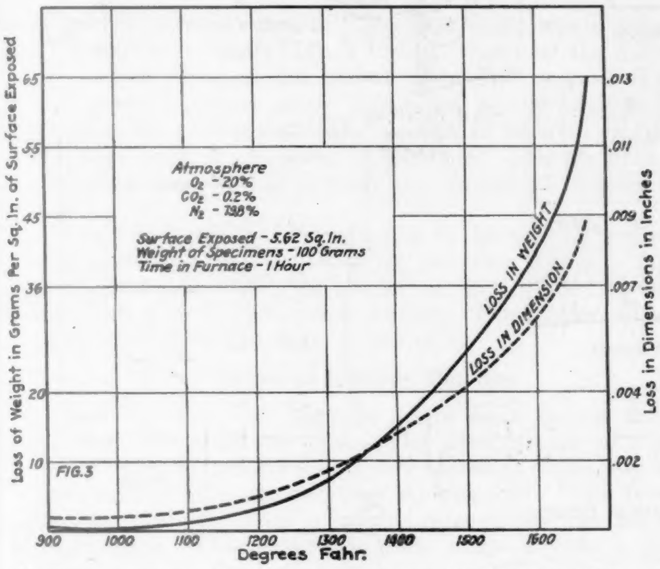


Fig. 3—Extent of Scaling on a 1.00 Per Cent Carbon Steel

Kinds of Atmosphere

In furnace literature, frequent mention is made of "oxidizing," "neutral," and "reducing" atmospheres. Consideration has been given in this work to the extent of scale formation in an atmosphere containing 20 per cent oxygen. Such an atmosphere is described as "oxidizing" and permits of the rapid formation of scale. Believing that certain misconceptions concerning the scaling properties of the "neutral" and "reducing" atmospheres are in existence, it is the writer's purpose to subsequently record the results of various experiments conducted in these atmospheres.

The distinctive qualities of the "neutral" atmosphere are as follows: (1) The absence of free oxygen. (2) The absence of combustible material. (3) The presence of either carbon dioxide or water vapor or both. (4) The presence of nitrogen.

It is logical that a consideration of the effect of nitrogen, water vapor and carbon dioxide upon heated steel will throw light upon the non-scaling properties of the "neutral" atmosphere.

Nitrogen—Since scale is an oxide of iron, it is evident that nitrogen will not enter into the formation of scale and may be dismissed from the discussion.

Water Vapor—Chemistry has established beyond the shadow of doubt that when heated in the presence of iron, water vapor dissociates and reacts with iron to form scale. The reaction may be expressed as follows:

$$3\,Fe + 4\,H_2O = Fe_3O_4\ (\text{Scale}) + 4\,H_2$$

Thus, the second constituent of the so-called "neutral" atmosphere is capable of producing scale.

Carbon Dioxide—When heated in the presence of metallic iron breaks down and reacts with the metal to form scale as follows:

$$2\,Fe + 3\,CO_2 = Fe_2\,O_3\ (\text{Scale}) + 3\,CO$$

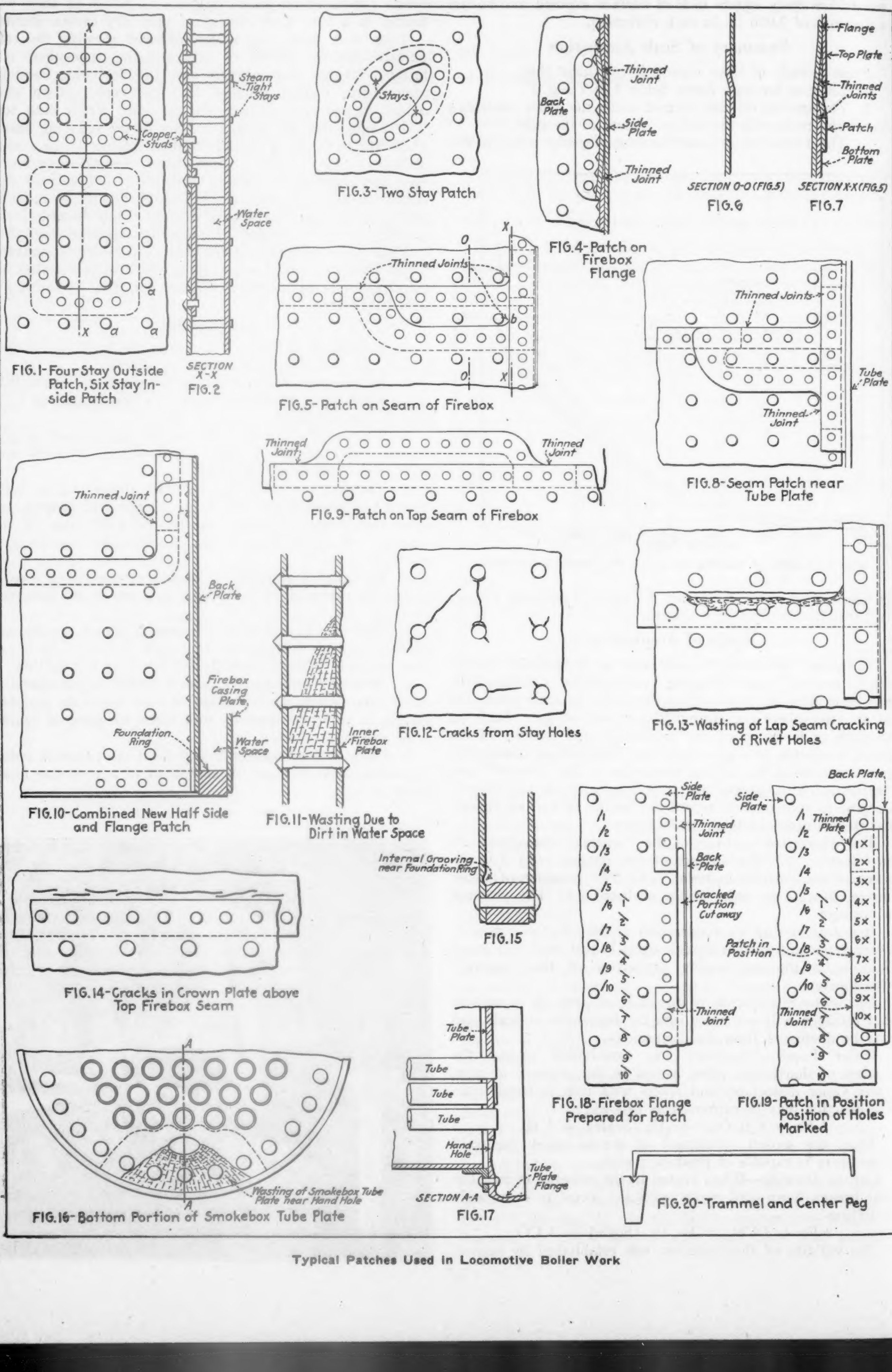
The validity of this equation was established by experiments conducted in which cylindrical pieces of steel were heated in a very slow current of pure dry carbon dioxide.

Tests were made and tables prepared showing the comparative scaling activity of the oxidizing atmosphere containing 20 per cent oxygen and the following reducing atmosphere: Carbon dioxide, 11.5 per cent; carbon monoxide, 0.8 per cent; oxygen, 0.0 per cent. From these tests it developed that the scaling activity of the reducing atmosphere at 1,700 deg. F. is only half as intense as the scaling activity of the oxidizing atmosphere. Several experiments have been conducted in which small pieces of tool steel were held from 10 to 15 min. at 1,400-1,600 deg. F. in reducing atmospheres. The pieces were discolored but no measurable quantity of scale formed. It, therefore, appears logical to conclude that regardless of the presence of carbon monoxide in the furnace atmosphere, scaling will take place when the temperature is sufficiently high and the time of heating is sufficiently long.

Conclusions

As a result of the data obtained in the foregoing investigation, the following conclusions are drawn:

1. In an atmosphere containing 20 per cent oxygen, little or no scale forms on steel exposed to a temperature of 1,200 deg. F. for one hour.
2. For straight carbon steels heated under identical conditions, the quantity of scale formed varies inversely with the carbon content of the metal.
3. The formation of scale becomes appreciable at 1,200 deg. F. in atmospheres containing 20 per cent oxygen, and from that point increases rapidly. At 1,600 deg. F. the quantity of scale formed may be fittingly described as excessive.
4. The neutral atmosphere, because of the carbon dioxide and water vapor which it contains, is active in the formation of scale.
5. Steel may be heated in mixtures of carbon dioxide and illuminating gas without the formation of scale. Such gaseous mixtures may be correctly described as non-scaling.
6. Reducing atmospheres, found under actual operating conditions, permit the formation of scale when the temperature is of sufficient intensity and when the time of heating is of adequate duration.
7. Pieces of steel may be heated for a short time in reducing atmospheres without the formation of appreciable quantities of scale.



Typical Patches Used in Locomotive Boiler Work

Practical Methods of Patching Locomotive Boilers*

British Railroad Boiler Makers Develop Effective Flange, Side Sheet, Barrel and Various Other Types of Patches

By A. Wrench†

PATCHING is extensively employed in the repair of locomotive boilers. This is brought about by the defects which occur in the firebox plates and seams. Firebox patches present many difficulties to the boilermaker owing to the narrow water spaces which in many cases make the water side of the plates inaccessible. This necessitates the use of studs instead of rivets as a method of securing the laps.

The most common form of patch is the side-plate patch, which varies in size to cover the defective portion. Such patches are called after the number of stays which they contain, thus 2, 4, 12 and 36 stay patches. Three types of these patches are shown in Figs. 1, 2 and 3.

Types of Outside Patches

The four-stay patch must be a laid on or outside patch, as must all square patches. The disadvantage of these patches lies in the fact that a large seam is exposed to the flame and pressure tends to force the patch off. This is not the case where the patch is inserted through the hole into the water space. The pressure on these tends to make a good joint.

The six-stay and two-stay patches shown in Figs. 1 and 3 are of this latter kind. It will be noticed that the studs with which the patches are secured to the firebox are between the rows of stays. This method has been found to make a better joint than when the seam is made between the stays, as stays in the seam of a patch tend to restrict breathing and cause leakages. The two-stay patch has two stays in the lap and is of irregular shape. This enables the patch to be passed through the hole and into the water space.

Method of Inserting Patches

It is necessary when inserting patches to remove three stays from near the bottom of the patch to allow it to be turned after it has been passed into the water space. These stays are marked *a* in Fig. 1. When using the outside patch this is, of course, not necessary. The marking-off of the holes in these patches is mostly done from standard templates. The stud holes should be marked so as not to be in line with the stays; this reduces the tendency to crack from stud to stay hole.

Mud Burns and Corrosion

An accumulation of dirt in the water spaces as shown in Fig. 11 is often found in locomotive boilers, and if neglected will allow the plates to burn and necessitate a patch. Cracks from stay holes and corrosion around stay heads Fig. 12 are also repaired by patching. Seam and flange patches are often used in the repair of locomotive fireboxes, and are more difficult to fit than the side-plate patches. The method of fitting usually involves the use of thinned joints.

Applying the Flange Patch

The flange patch, Fig. 4, is used to repair flanges which have cracked in the root or bend. The cracked portion is cut away and also a portion of the flange is removed. The joints are then thinned and made ready to receive the patch. The patch is placed in position, and the holes marked off by the trammel method. This method of marking off is explained by Figs 18 and 19. Centered pegs are inserted in the hole prior to the patch being placed in position, and points marked in two places on the firebox side. The patch is then fixed with a screw and pipe, and the position of the holes marked from the two corresponding places on the firebox side. This method of marking-off is adopted on all laid-on seam patches where the water space does not permit the use of a scriber.

Fig. 5 shows a patch used to renew a portion of the lap of a seam which is found to be wasted and badly cracked. This patch has one seam inserted in the water space while the other is on the fire side of the plate. This is necessary as the position of the patch shown in the illustration is near the fire-hole flange and in a position where it is in contact with the flame. Thinning of joints is employed to enable the patch to fit properly. The thinning of the joint marked *b*, Fig. 5, is verv difficult, as this work has to be done under the flange of the fire-door plate. To enable this to be done this flange is lifted by a wedge after several rivets have been removed. This patch forms a good repair and gives very little trouble from leakage in service.

A similar patch to this one is shown in Fig. 8, but this is an outside patch, the two thinned joints of the patch being passed under the flange. This type of patch is usually employed on the seam near the tube plate, and being well away from the fire gives satisfaction during working.

Combination Half Side Sheet and Flange Patches

Frequently when a firebox has been working for some years it is found advisable to renew the bottom half of the side plates. In addition to this, the flanges may need patching. It is the practice of some firms to fit new half-sides and then patch the flanges. Fig. 10 shows a combined half-side and flange patch. It will be noticed that the flange is transferred from the side plate to the back plate, a row of rivets being dispensed with. The top of the new flange must extend above the half side seam to enable a good-shaped thinned joint to be made. This method of repair is considerably cheaper than the fitting of a flange patch separately and is quite satisfactory in service.

Cracks, such as shown in Fig. 14, which occur about the side plate seam which are due to the upward expansion of the firebox, are repaired by a patch inserted under the lap, the cracked portions having previously been cut away. Such a patch is shown in Fig. 9. Grooving near the foundation ring and cracked outer firehole plates are repairable by patching.

Smoke Box Tube Sheet Repairs

Figs. 16 and 17 show a defect of the smoke-box tube-plate caused by leakage from the hand hole. This is repairable by a patch which should be made of copper to enable it to be properly fitted on to the wasted portion. The writer once fitted a steel patch on a tube-plate similar to the one shown, and had considerable difficulty in making a proper fit. The patch had to be bolted up several times while hot, and some of the holes were drawn out of true. This drawing was allowed for by drilling the holes small, but this necessitated the use of bolts of small diameter and little drawing power.

Inserting and screwing up bolts in a hot patch is difficult

*Reprinted from Engineering, July 28, 1922.
†Member Institute of Locomotive Engineers.

and the patch cools considerably before the hammer can be applied to do the necessary bedding-on. Filling the corroded portions with cement or red lead is not to be recommended.

The throat plates of some types of boilers crack on the shoulders, and boilers fitted with Belpaire fireboxes develop corrosive grooving at the junction of the throat plate with the barrel at the top. These two defects have been successfully patched, and new boilers are now built with extension plates to cover each of these two places. This practice stiffens the boiler at the two points and delays the time when a patch will be necessary.

Strength of Barrel Patch Seams

When the bottom of a locomotive boiler becomes corroded, patching, when properly designed, makes a good repair. It is not always recognized that the riveting of a "barrel" patch in a longitudinal direction should be equal in strength to that of the longitudinal joint. Many of these patches are merely single riveted with a narrow pitch of rivets. Considering that these patches are cover patches, a narrow pitch of rivets is not necessary and an efficiency of plate section should be maintained equal to that of the longitudinal joint.

When designing the rivet section to be used in these patches the tenacity of the corroded plate may be considered, as, unlike the longitudinal joint, the boiler plate underneath the patch would have to break before the rivets could shear. "Barrel" patches are usually joggled to fit over the circumferential seam, the seam being chipped near the seams of the patch to make a good fit. If any space then occurs between the plate and the patch a wedge is driven in and calked.

It will be seen from the foregoing remarks that repairing boilers by patching is an important branch of boiler maintenance which should be studied by those responsible for the safety of steam boilers. Inspectors occasionally find that the strength of a boiler has been much reduced by improper patching, and several explosions have been found to be due to this cause.

Principles of Oxyacetylene Fusion Welding Part 8—Cutting Cast Iron

By Alfred S. Kinsey*

While on the subject of the fusion *welding* of cast iron, it might be of interest to describe the *cutting* of cast iron by the oxyacetylene torch. Until a few years ago it was thought that the only metal which could be cut in this way was low carbon steel. Oxyacetylene writers had said that cast iron could not be cut by the oxyacetylene torch because of the proportionately high percentage of carbon in the metal. The carbon was supposed to prevent the oxidation of the metal, as occurs in the cutting of steel. Another explanation of the failure to cut cast iron was that its oxide melted at a higher temperature than the pure iron, called ferrite, and that the oxide insulated the ferrite from the heat of the flame so that ignition could not be obtained.

Fig. 1—Cutting Through 12 Inches of Cast Iron

However, there were reasons for believing that cast iron could be cut with the oxyacetylene flame, which led the writer about two years ago to perform experiments to determine just what could be accomplished. It was soon determined that the metal could be cut, and that the chief reason this had not been discovered before was that the cutting flame had not been powerful enough and experimenters had not gone far enough.

Theory of the Cutting of Cast Iron

It will be remembered that cast iron contains carbon, silicon, manganese, phosphorus and sulphur to the extent of about 7 per cent, the remaining 93 per cent being pure iron. The cutting of cast iron by the oxyacetylene flame depends largely on the oxidation; that is, the actual burning of the metal, and it is well known that the smaller the amount of chemical elements in the metal the easier it may be cut. Therefore steel cuts more readily than cast iron.

The carbon in cast iron is in two forms, graphitic and combined. The graphitic carbon is not part of the pure iron itself, but lies between the flat-sided grains in flakes. On the other hand the combined carbon, just as the name implies, combines with the pure iron and becomes part of it, thus forming iron carbide.

When the cutting torch starts to oxidize, or burn its way through cast iron the oxygen from the torch tries to reach the pure iron, which would readily receive it; *i. e.*, they have an affinity for each other, because it was the original nature of the iron to be united with oxygen and it is the way iron is always found in the earth, *i. e.*, as iron oxide In cast iron, however, the chemical impurities may interfere, especially the graphitic carbon whose flakes lying between the grains of metal retard the burning, just as for example some sheet steel placed between layers of wood would delay the burning of the wood.

Therefore the cutting of cast iron is inclined to go slowly and is not as perfect as the cutting of soft steel, which has

* Professor of shop practice, Stevens Institute of Technology, advisory service engineer, Air Reduction Company.

less than one per cent of chemical impurities and no graphitic carbon flakes to interfere. It is quite possible to bring about a combined burning of the pure iron and melting of the oxide, which undoubtedly is due to the unusually large supply of oxygen and acetylene used by the torch, and to

Fig. 2—Cutting 14-In Steel. Very Little Smoke

the additional fire created in the kerf by the excess of acetylene.

The cutting of cast iron is accompanied with quite some fire and smoke, as shown in Fig. 1. This is caused undoubtedly by the burning of the large amount of graphitic carbon. In comparison there is very little smoke when cutting steel (Fig. 2).

Effects of Cutting on Cast Iron

There is a liberal amount of slag and molten metal from the cutting. The kerf is quite a little wider than that of

Fig. 3—Completion of 12-In. Cut of Cast Iron

steel. The surface of the cut will be covered with a heavy oxide scale, but a hammer blow will shatter and remove this (Fig. 3). The cutting will probably take some of the carbon out of the iron at the cut, but practically there will be no increase of the hardness of the surfaces of the kerf. This very likely is due to the fact that the slag from the cutting covers the surface of the metal with a scale which allows the iron to cool slowly enough to keep the carbon in the graphitic condition and thereby avoid the hardening of the metal.

How to Cut Cast Iron

A regular medium pressure torch for cutting steel may be used, and only a special tip is necessary. The torch should be held so that it is tilted slightly backward for soft gray iron and more so for the harder irons.

The ignition spot on the iron must be bigger and hotter than for steel in order to insure a good start. The variableness of the hardness of the iron in most castings, and also blow holes will affect the cutting, sometimes "putting out the fire." A little spiral motion of the tip, however, usually will overcome the trouble. On the other hand, such a motion also will widen the kerf, thereby increasing the gas consumption.

The preheating flame should be adjusted with an excess of acetylene in order to give a carbonizing jet from 1 to 2 in. long when the high pressure oxygen is snapped on.

The gas pressures are higher than those used for steel, and may be taken from the following table:

CAST IRON CUTTING PRESSURES

Tip Number	Thickness of Metal in Inches	Oxygen Pressure Lb. per Sq. In.	Acetylene Pressure Lb. per Sq. In.
1	½	20	4½
1	¾	30	4½
2	1	30	5
2	1½	35	5
2	2	45	5
3	3	55	7
3	5	75	7
4	7	95	9
4	9	125	9
5	10	130	10
5	12	150	10

These pressures are necessarily approximate as they will vary with the hardness of the casting.

Fig. 4—Cutting Up Scrap Locomotive Cylinders

The cutter should make certain that the oxygen supply is maintained at constant pressure. It is liable to drop due to rapid consumption and thereby affect the flame so as to stop the cutting.

The casting will not need to be preheated other than by the preheating flame of the cutting torch. The oxygen does not need to be warmed. The cutter will find it necessary to protect his flesh, shoes and clothing from the heat and flying sparks.

Economy of Cutting Cast Iron

The cost of cutting cast iron is about five times that of cutting steel. Cast iron can be cut at a rate of about 7 sq. in. per min., while steel can be cut at 30 sq. in. per min. The following are safe figures to use:

To Cut 100 Square Inches of

	Cast Iron	Steel
Time, min.	15	3.5
Oxygen, cu. ft.	123	25
Acetylene, cu. ft.	21	2
Cost for oxygen	$1.85	$ .35
Cost for acetylene	$ .55	$ .05
Cost for labor	$ .20	$ .05
Total cost	$2.60	$ .45

While these figures show the relative cost of cutting cast iron to be high, it is fair to note that the only other way to cut the metal, which is by machinery, would cost at least twice as much as cutting it with the torch. Fair comparative figures would therefore be:

To cut steel by the oxyacetylene torch	$0.45 per 100 sq. in.
To cut cast iron by the oxyacetylene torch	2.60 per 100 sq. in.
To cut cast iron by machinery	5.00 per 100 sq. in.

While it is not to be expected that cutting cast iron with the oxyacetylene torch will have as wide application to shop practice as cutting steel, it is proving to be of valuable service in many ways, of which we may well give some illustrations.

Worn out locomotive cylinders are too big to get through

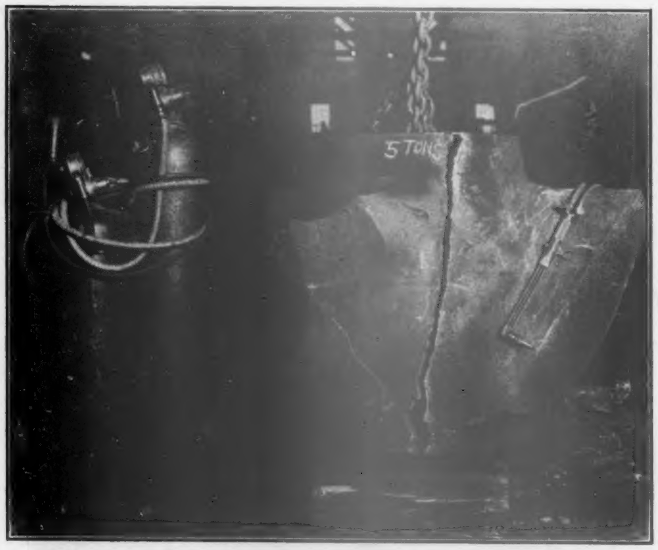


Fig. 5—Cut Made by Torch Through Cast-Iron Propeller Hub Weighing 5 Tons

the charging door of a cupola for remelting. It was the practice to break up these scrapped cylinders with the skull-cracker in the scrap yard, but safety committees are now condemning the use of the skull-cracker, unless the breaking of the castings is done within the confines of a high brick wall, to prevent the flying pieces of cast iron from injuring workmen. Not many railroad scrap yards have such a high wall. Here is where the cutting torch will be of value, as the cutting up of the cylinders may be done quickly and at reasonable cost, considering that the cylinders must be disposed of (Fig. 4).

Another application of the cutting torch on cast iron is to be found in the removal of worn bushings of locomotive cylinders and steam chests. These were formerly chiseled out, but the torch is now cutting them out in one-tenth the time. No damage is done to the cylinder wall by the cutting.

Heavy sections of cast iron are easily disposed of, as may be illustrated by the cutting up of a hub of a propeller. A cloud of smoke usually comes from the graphitic carbon in the cast iron. Fig. 5 gives a good idea of the slot, or kerf, made by the cutting torch, while Fig. 6 reveals the character of the cutting as the two parts of the hub are separated. The cut is rougher than would be found in a more important job. This scrap casting was a problem to its owners. It could not be smashed, it dare not be thrown overboard, it looked as if it would have to be buried to get it out of the way, when the cutting torch proved to be the solution.

The cost figures for this job may be of interest. They were:

Oxygen	$15.00
Acetylene	6.85
Labor	1.56
Total	$23.41

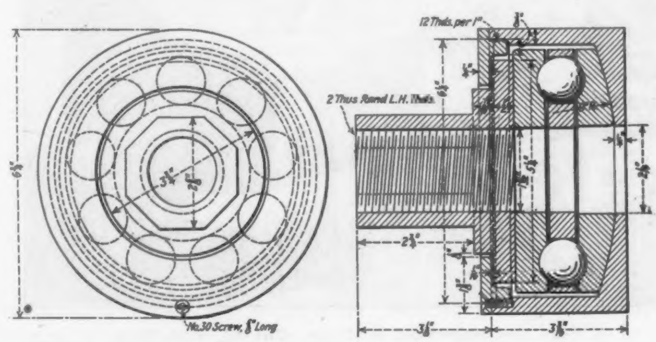
There are many other cases in which the oxyacetylene cutting of cast iron has proved of good advantage, such as

Fig. 6—Cast-Iron Propeller Hub After Being Cut by Oxyacetylene Cutting Torch

the beveling for big cast iron welds, cutting cast iron pipe, cutting up the cast iron bases of machines, making alterations in iron castings in locomotive shops, and other similar work.

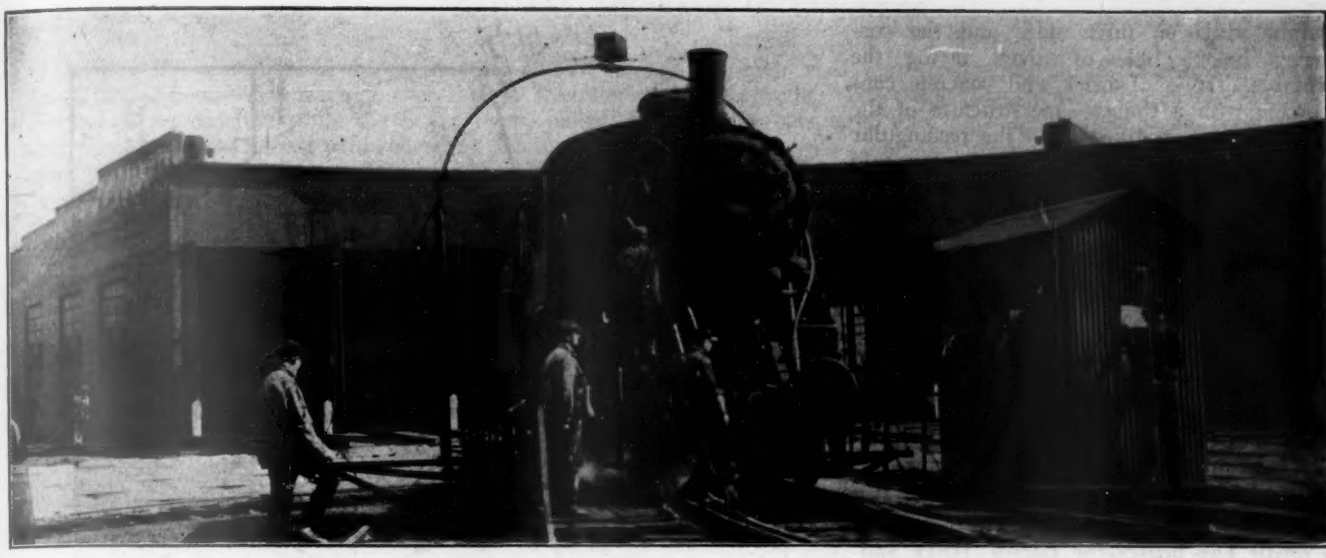
Ball Bearing Nut for Valve Bushing Puller

The work of pressing in or removing piston valve chamber bushings as ordinarily performed, is a laborious task. Power-operated devices for doing this work often are not satisfactory because they are unwieldy and require considerable time



Details of Construction of Ball-Bearing Valve Bushing Nut

to set up. A method which has proved highly satisfactory is to use a ball-bearing nut of the type illustrated. This reduces the friction materially so that by the use of a long-handled ratchet wrench the bushings can readily be applied or removed by hand.



From the Turntable Side

Erie Builds New Enginehouse at Jersey City, N. J.

An Old Structure Destroyed by Fire Is Replaced Without Interference With Locomotive Operations

THE Erie Railroad has recently completed a new engine terminal at Jersey City, N. J., which includes a 21-stall enginehouse, machine shop and other facilities, the construction of which was carried on "under traffic." It replaces an old layout which was destroyed by fire and was built on the old site without interference with operation, the old turntable and radial tracks being kept in use for the turning and servicing of both passenger and yard locomotives. Because of the restriction as to location and space and the necessity for non-interference with the motive power movements, the design and construction are both novel and interesting. The new building is a combination of a radial type 105-ft. enginehouse and a rectangular building.

General Arrangement of the Machine Shop

The old enginehouse was of timber construction with 21 stalls served by an 80-ft. turntable and adjoined Pavonia avenue, a heavy trucking thoroughfare ending at the ferries. The back wall of the structure was parallel to the street line, a plan that was followed in the construction of the new enginehouse. In conjunction with the 21 stalls in the enginehouse, there was a repair bay containing 8 tracks, which connected with 6 radial tracks at one end and with a transfer table at the other. This transfer table is located between and serves the repair bay and a rectangular enginehouse of 12 tracks known as the "long" house. The fire destroyed the main part of the layout, leaving only the transfer table and the "long" house. Most of the engine pits, which were of timber, were badly damaged.

Jersey City is the eastern terminal of the Erie and, as a result, a large freight and passenger business is handled at this point. In addition there is a heavy commuter traffic. The freight engines and through line passenger engines as well as a large number of switching and yard locomotives are turned at the Secaucus engine terminal in the Hackensack meadows. The Jersey City enginehouse is primarily for the servicing of the commuter engines although all of the New York division passenger locomotives and a few yard locomotives are also handled there. About 200 engines are turned daily at Jersey City which, in connection with the congested layout, presented a problem that was easily rendered serious by the loss of the enginehouse. It became imperative that the utmost speed be developed in erecting another structure with a minimum of interference to engine movements and motive power repair requirements since under the circumstances the old tracks had to be continued in use. At the same time it was desired to use this opportunity to modernize the layout. The result was that construction and design proceeded almost simultaneously and both were largely prescribed by the existing conditions, predominant among which was the location of the turntable.

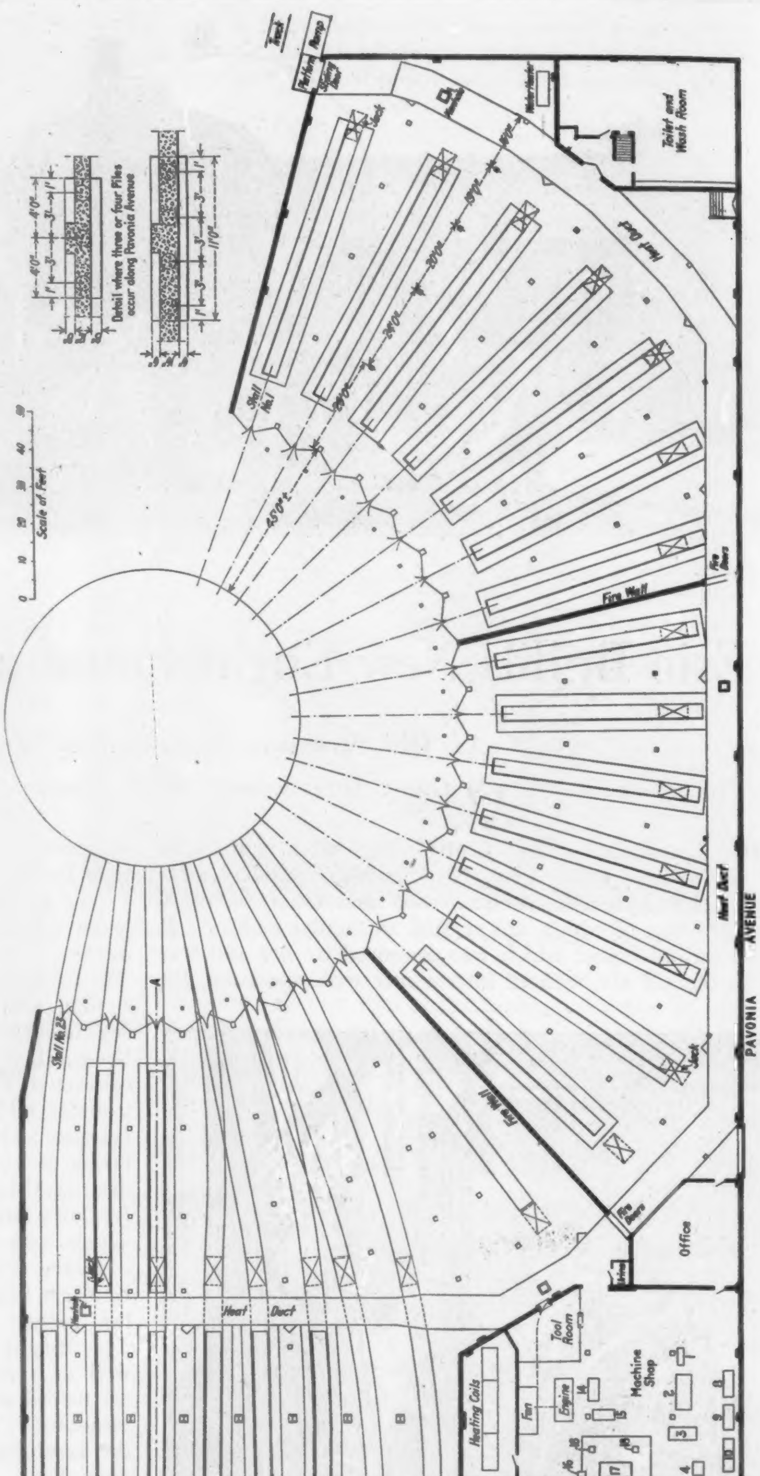
The new layout is a rectangular shaped building, having

straight walls on three sides and the customary inner circle of doors facing the turntable. It is of brick and concrete construction with a timber superstructure of the shed roof type modified to fit the rectangular shape at the corners and where joining into the machine shop and the repair bay monitor. There are 21 stalls, divided into three sections of seven stalls each, one section adjoining and actually being a part of the eight-track repair bay of the monitor type. In one corner of the rectangular house beyond the radial section is located a large machine shop, the boiler and engine room, forges, air compressors and pumps, hot air heating equipment and the offices. A similar corner, although smaller, at the other end has been utilized for the wash-room, shower baths, and lavatories and above this, in a small second floor, are located the lockers. A lean-to adjoining the north wall of the repair bay houses the pumps, tanks and other machinery for a complete boiler washing system.

The engine stalls are designed on the basis of a standard 105 ft. house with five bays spaced from inner to outer wall at distances of 26 ft., 24 ft., 20 ft., 19 ft., and 16 ft. The limiting factor of the distance from the center of the turntable to the street line made it necessary to continue the old angle between tracks of about 8 deg., 12 min., 49 sec. in order to secure sufficient clearance at the doors, instead of the usual standard of the Erie for this length of stall of about 7 deg. The roof structure is of timber overlaid with Barrett roofing and is supported upon wooden posts spaced as described above.

The repair bay is of the monitor type with a steel superstructure fabricated from floor beams, chords, etc., taken from an old steel bridge across the Susquehanna river. This work was done by company forces, the erection being handled by the bridge gangs. A 15-ton electric traveling crane will be installed in this section of the building, provision having been made in the design and construction for this purpose. The crane bay is 42 ft. 7½ in. wide from center to center of posts and runs the full length of this section. A Whiting hoist of 200-ton capacity has also been installed in this section in conjunction with four new concrete pits. Other crane and hoisting facilities consist of a series of six post cranes of 16-ft. radius installed at convenient points throughout the house.

Within the circle there are three stalls without engine pits, five with old wooden pits, four of which have been extended with concrete, and 13 new concrete pits with inside lengths varying from 52 ft. to 89 ft. This seven-stall section at the east end of the house has been floored with 6 in. of concrete poured with depressed drains on each outer side of the pit rails. These drains connect with the engine pits and carry off quickly any water which may accumulate on the floor during boiler washing, this section being used chiefly for that purpose. One pit contains a concave section of track with a 5½ in. drop, an arrangement which permits of easy removal of spring hangers, etc., without use of drop pits



General Plan of the Erie Enginehouse Layout

or hoists. The remainder of the enginehouse and repair bay has a cinder floor. The machine shop floor is Kreolite wood block laid on concrete while the boiler room, blower room and pump room are floored with concrete. Alternate installations of Johns-Manville and Dickinson smoke jacks have been made on which to secure comparative performance data.

The structure is heated by a modern installation of heating coils and blower discharging into a concrete air duct situated below the floor and around the outer circle. This duct is tapped between each two stalls by lines of vitrified clay pipe which carry the heated air to the engine pits. Wherever the enginehouse tracks cross the duct, the upper slab has been reinforced and in addition, the running rails are carried in a double rail trussed construction of ample strength.

Electrically Equipped for Economical Operation

The power used in the enginehouse for machine shop and other uses, is purchased from an outside source supplying two-phase energy at 2,300 volts, and 60 cycles which is stepped down to 220 and 110 volts according to needs. A unique method has been utilized to prevent the destructive action of gases on wiring installed in conduits above the gas line. From the switchboard at one end of the enginehouse, the conduit is led out through the street wall and along and over the exterior of the building. At points where it was necessary to run wiring above the gas line, it was accomplished by mounting the wire on glass petticoated insulators supported on the rafters.

Lighting and Welding Facilities

On the inside of the street wall, two 100-watt lighting units are installed between stalls and so arranged that the light beams from each will cross each other, both also being inclined downward to an angle of about 15 deg. from the horizontal. A single unit of this type is mounted on the door posts. The circuits for this latter installation are brought over the roof of the enginehouse and down on the outside of the door posts. Three flood lights mounted on the roof, keep the turntable well lighted at night. Facilities for arc welding are furnished by two Wilson two-man sets delivering sufficient current for four welders through cables tapped at each stall and terminating in a 150-ampere charging receptacle. The welder simply plugs in his welding lead at the proper receptacle, removing it when he has completed his work.

The majority of the machine tools are belt-driven from an overhead line shaft operated by a 50-hp., 220-volt, two-phase motor with a 30-hp. motor in reserve which can be substituted immediately by throwing on a belt. Two large turret lathes, a blower fan, and a large Ingersoll-Rand air compressor unit have individual motor drives. The latter unit is of the duplex, two-stage, constant speed type with a capacity of 1,574 cu. ft., the regulation of the supply being accomplished by a five-step clearance control which loads or unloads the compressor in five successive steps, according to needs. The motor is a 260-hp. synchronous motor operating on 2,300 volts. The plant supplies air at 100-lb. pressure for use in the electro-pneumatic interlocking plant, for charging train lines and for various shop and enginehouse requirements.

The air line to the enginehouse stalls is carried on brackets with other pipe lines suspended from the rafters and following around the building 30 ft. inside of the doors. There are five distinct lines, aside from the steam line, consisting respectively of a 3-in. air, a 4-in. cold water, a 4-in. filling, a 4-in. washout and a 5-in. blow-off line. Each pit has individual connections.

Boiler Washout Section, Showing Depressed Drains, Post Cranes, Etc.

The Machine Shop Equipment

The machine shop is well arranged and well equipped for the work to be performed, which consists entirely of light running repairs. Should heavier repairs be required, a locomotive is sent to the North Shop on the other side of the tracks. At the entrance from the enginehouse to the shop there is a toolroom which serves all the men whether working in the shop or on locomotives. Adjoining this on the same side is a double blacksmith forge with a blower, two anvils and a trip hammer. A 3½-in. bolt threader is also placed on the same side of the room in a position for convenient use.

Six engine lathes are arranged in line along the street side of the shop. These range in size from 14 in. by 6 ft. to 36 in. by 20 ft. In front of the lathes is a 60-ton rod press, a double-end emery wheel grinder, a 42-in. drill press,

a 4½-ft. radial drill, a 28-in. shaper, a 24-in. vertical turret lathe, and a 42-in. vertical boring mill.

List of Shop Tools and Equipment

The location of the various machine tools is shown on the general plan by numbers given in the following table:

1—60-ton rod press.
2—4½-ft. Mueller radial drill press.
3—28-in. Smith & Mills shaper.
4—20-in. by 3-in. double-end emery wheel grinder.
5—42-in. drill press.
6—24-in. Bullard vertical turret lathe.
7—42-in. Colburn vertical boring mill.
8—14-in. by 6-ft. Cisco engine lathe.
9—17-in. by 8-ft. National engine lathe.
10—18-in. by 8-ft. National engine lathe.
11—18-in by 8-ft. National engine lathe.
12—28-in. by 12½-ft. Boye & Emmes engine lathe.
13—36-in. by 20-ft. New Haven engine lathe.
14—3½-in. Adams bolt threader.
15—Trip hammer.
16—Buffalo forge blower.
17—Double blacksmith's forge.
18—Two anvils.

Protection Against Future Fires

Ample precautions have been taken for proper fire protection in addition to the fire walls between each of the seven stall sections and between the machine shop and the enginehouse proper. A fire pump situated in the machine shop connects with the main intake water supply by a system of valves which are normally set so that the water is by-passed around the pump. Each valve is plainly numbered while a large chart shows clearly what valves should be turned to deliver water to any section of the building or the yard. Fire hose connections have been installed between every two pits within the building, as well as on the roof structure, there being five in the latter instance alone. In addition numerous other hydrants are installed in and around the remainder of the building.

Methods Necessitated Close Co-operation

The construction of the Erie house necessitated close co-operation between the engineering, motive power and operating departments. The broad plan adopted was for the construction forces to be allowed three tracks at a time, free from interference while the operating department would deliver each 24 hours the designated cars of material before the starting of work each morning. The engineer in charge of construction was given authority to move engines in the roundhouse not under repair from stall to stall according to the needs of the occasion. This factor in itself eliminated much waste motion since it was possible to return one or more tracks to the motive power department and take possession of others promptly, thus keeping the construction forces and equipment steadily at work.

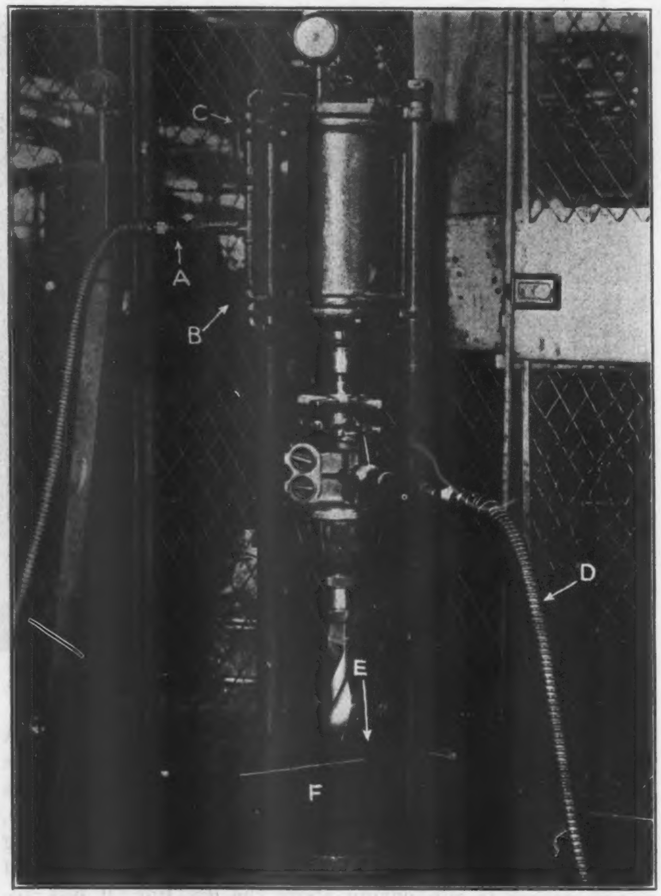
The new enginehouse was designed by the engineering department of the Erie, R. C. Falconer, assistant to the president and chief engineer, C. H. Splitstone, superintendent of construction and surveys; F. A. Howard, engineer of structures, and O. V. Derr, resident engineer, in active charge of construction in the field. The Austin Company, Cleveland, Ohio, was the contractor for the superstructure and Frank D. Brown of Jersey City, N. J., for the substructure.

Air Motor Testing Device

In view of the large number of pneumatic motors used in railroad shops it is essential that they be kept in good repair and operating as near as possible at maximum efficiency, otherwise there will be a large aggregate loss of time and effort in doing the work. There is nothing much more discouraging to a machinist on locomotive frame work, for example, than to be compelled to drill out old frame bolts with a motor which lacks power or cannot be accurately controlled by the valve.

Various forms of brakes have been developed for testing air motors but results obtained with this form of apparatus are not wholly reliable since the motor spindle is not subject to pressure as in actual service. The apparatus shown in the illustration has been developed at the McKees Rocks shops of the Pittsburgh & Lake Erie for the purpose of testing motors under actual working conditions. As shown in the illustration the device is simple, consisting of an 8-in. air brake cylinder mounted in a vertical position between two heavy rods secured in a substantial base casting. The upper ends of the rods are turned down to 1½ in. in diameter to accommodate the special cylinder heads which serve to hold the cylinder in place. The lower sections of the vertical rods are retained at their original diameter of 2¼ in.

For purposes of test, a motor is mounted in the device as shown, being guided at the drill by crossbar *E* and resting on test block *F*. Air is supplied to the cylinder through the flexible hose on the left and valve *A*. Valves *B* and *C* are three-way cocks so arranged that when *B* is closed and *C* opened, for example, air is admitted on top of the cylinder and exhausted from the bottom. This forces the piston down on top of the air motor with a pressure indicated by the gage and which can be regulated to any desired amount. Air is supplied to the motor by means of hose *D*, and after the test is over the motor can be released by closing valve *C* and opening valve *B*. There is approximately 100 lb. pressure on the shop line.



Home-Made Air Motor Tester

For testing, the air motor is set up as illustrated with a 2-in. drill in the socket, the drill point resting on test block *F*. Pressure is applied slowly until the air motor is pulling to capacity. The revolutions per minute can then be counted and the pressure noted. The pressure required to stall the motor can also be noted, and, provided the condition of the drill point as regards sharpness is kept constant, this pressure will be a measure of the efficiency of the air motor. If the motor does not come up to the requirements it can be overhauled and the difficulty corrected.

Some Faulty Shop Methods

By Thomas E. Stuart

IT is often said that we learn by making mistakes. The wise man, however, does not make the same mistake twice, nor does he knowingly repeat mistakes made by others. It is my purpose to cite some examples of bad shop practice and while some of these practices are palpably wrong they are still followed in a few shops.

Blocking Under Cylinders

The first pertains to boring locomotive cylinders. In a certain shop, locomotives after being stripped for heavy repairs are placed upon blocks. A timber is placed across the pit at the firebox end under the frames. The weight of the front end is carried on blocks placed under the cylinders. In this position cylinders are bored.

To ascertain the distortion of the cylinder walls due to the weight thus placed upon them, they were calipered and found to be from .030 in. to .060 in. less in vertical diameter than in horizontal diameter. As the vertical diameter is always greatest in worn cylinders due to the wear being largely concentrated on the bottom of the cylinder, it will be seen that the distortion was in excess of the amount shown by calipering. Boring in this position did possibly produce a truly round cylinder, but it would remain round only as long as the weight remained on the cylinder walls. On relieving the cylinders of the stress they would naturally return to their normal shape, when it would be most difficult to determine what the actual shape of the bore was.

It is not an easy matter to secure perfectly fitting rings in a truly round cylinder. The fit of rings in a cylinder bored in the manner just described, would be difficult to imagine. It is doubtful if they would ever wear down to a bearing during the time a locomotive ordinarily spends between shoppings.

In the same shop, it is the practice to press in cylinder bushings with an allowance of from .008 in. to .012 in. over the bore. I do not believe it is possible to attain the larger figure in cylinders of ordinary size even when properly bored. With cylinders bored as stated, it could not be done. The allowance should not exceed .004 in. for cylinders up to 30 in. in diameter, and measurements must be carefully made to attain this accuracy. Bushings should in every case be pressed in solidly against a shoulder formed in the cylinder wall, and the front end should project enough to face off flush with the front end of the cylinder so that the cylinder head has a firm bearing against the bushing in a ground joint.

Excess Wheel Lathe Capacity

A new driving wheel lathe of the most modern type was installed in a shop and tried out to the limit of its capacity for the purpose of making a record. The machine proved capable of turning three times as many tires as the output of the shop required when working normally and without overtime. Since the overhead cost on the machine much exceeded the operating cost, including labor, power, tools, etc., there was nothing gained in a financial way by pushing the machine to its limit of output. On the other hand, some of the work was so hurriedly done that roughing tool marks were visible in the treads of the turned tires, in some cases 1/32 in. deep in the center of the tread. If there is one thing that should be essential in a newly turned tire, it is that the contour be exact and the tread smoothly finished, otherwise the wear is most severe and greatest in the first few hundred miles run. The tool marks would be speedily rolled out, causing at the outset considerable wear and loss of contour. If the remainder of the tire wore out at an equal rate, the tire bill would be out of reason.

In fitting piston valve bushings, it is essential that the bores be perfectly round and true and that the two halves of the bushing be in perfect line. This can only be accomplished by making the external surface and the bore exactly concentric, or by boring the bushings after they have been pressed in.

To make the outer and inner surfaces of the bushing truly concentric both of these surfaces should be finished at one chucking. Yet in one shop the bore is finished on a vertical boring mill and the bushing then removed to a lathe to finish the exterior. No mandrel or other absolute centering device is used in the lathe and consequently much time is lost in centering with much probability that the centering is not accurately done. Bad fitting bushings frequently are the result. It would be much simpler to alter the pattern for bushing castings so that these could be chucked, bored, turned and cut off with absolute certainty of true, concentric work, thus securing better fitting and working valves.

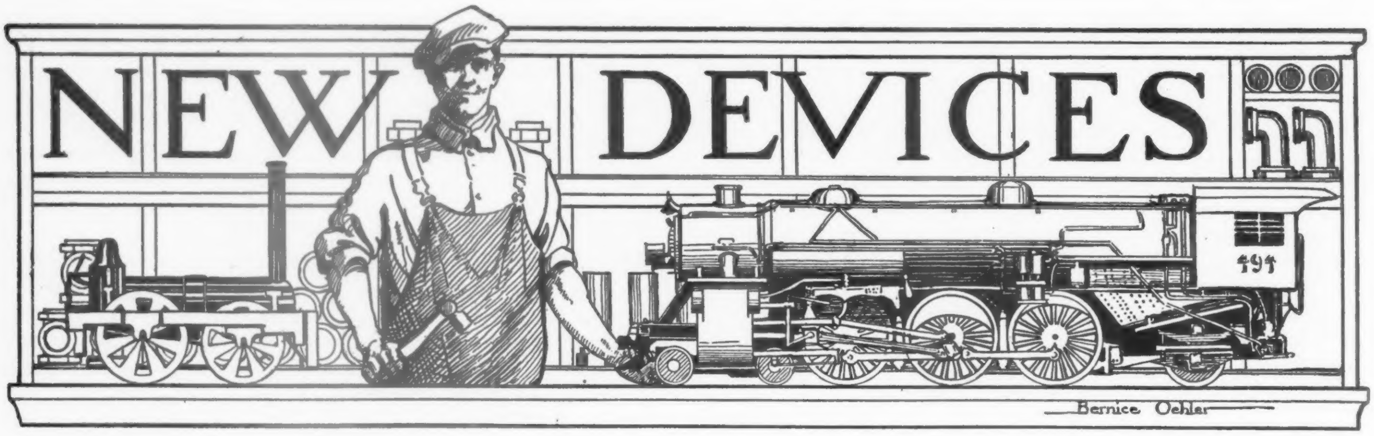
Long practice has conclusively demonstrated that valve motion parts having a reciprocating movement, should have bearings formed of a case-hardened bushing, with case-hardened and ground pins. When properly made and fitted, the wear is comparatively light and the life equal to the engine's mileage, or more. Yet I have seen the practice followed of making the bushings in a lathe, case-hardening them and pressing them into place without grinding. The lathe work was none too good and the finish consequently poor, yet the shop which followed this practice nearly always ground the pins using a tool room cylindrical grinder with a wheel having a ½-in. face. This was a waste of time and labor when the nicely finished pin was put into a rough case-hardened bushing. In the present day, small internal grinders capable of a large output in the hands of even an apprentice boy, can be had for a moderate price. Plain cylindrical grinders are in use in every shop where production is a first consideration and high class work the only thing that will be tolerated.

At another shop, the practice of making bushings from seamless drawn steel tubing was followed until a blacksmith shop foreman demonstrated that bushings, as good or better, could be made to rough sizes in a forging machine at about one-sixth the cost.

Main and Side Rod Replacements

As a final illustration of the effect of shop methods on locomotive maintenance costs, no better example can be offered than a comparison of the practice of two separate roads as regards main and side rod replacements. On road *A* the rod replacements average about one a month for approximately 300 locomotives, practically all of which are of heavy type. In the shops of this road it is the practice to mill rods all over, providing a finish equal to or better than the locomotive builders. On road *B* which has about 1,000 locomotives of all classes, I have seen as many as 100 new rods going through the shops at one time, and it is customary to order them in lots of ten or more. Main rods are finished on the planer, the only milling done being that necessary to afford a tool clearance on fluted rods. Side rods are left as they come from the hammer except at the ends which are planed and slotted. The rod breakage on road *B* is many times that on road *A*.

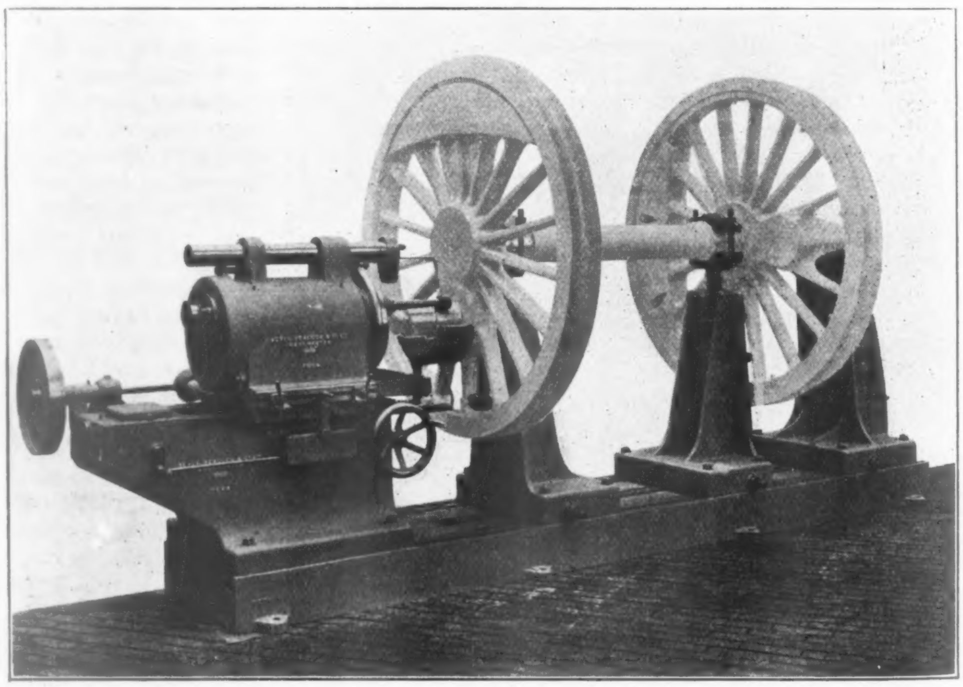
What is responsible for the difference? It is a well known fact that parts of a machine that are subjected to a reversal of stress will invariably break at some point where there is a flaw, tool mark, or some other weakening influence which serves as the starting point of a crack that eventually terminates in a failure. This is true, regardless of what the original material may be. High tensile strength steel will obey this rule just the same as will ordinary material, the only difference being that it requires a longer time to bring it about. Properly designed and above all, properly machined rods of good material, will inevitably prove to be cheaper.



Modern Crank-Pin Grinding Machine

THE machine, illustrated, is designed by Beyer, Peacock & Co., Ltd., Manchester, England, for grinding locomotive crank-pins when mounted in position in the wheels. An accurate, smooth surface is produced, concentric with the original center, and a minimum amount of material is removed, necessary to produce a true pin.

The machine consists of a horizontal grinding head in which a high-grade steel spindle revolves at high speed, and in addition has an eccentric motion imparted to it by sleeves driven by worm gearing. The amount of eccentricity is variable while the machine is running, and by this means the grinding wheel is fed to or from the work being ground. The spindle runs in ball and roller bearings, having dust-proof caps, and is supported close to the wheel by a smooth bearing. The head has longitudinal traverse on the bed, controlled by a sensitive reversing gear and stops. The bed is bolted to a substantial base-plate on which slide the quartering tail-stock and axle support brackets. Hand motion is provided by rack pinion. The tail-stock has vertical adjustment obtained by means of screw gearing and is fitted with a centering bracket for right and left hand cranks. The cranks are accurately quartered at the grinding head by a pin which enters the turning center of the crank-pin to be operated upon, the other crank-pin is centered by a pin in the bracket of the tail-stock, this latter pin being placed at right angles to the grinding head pin.


Crank Pin Grinding Machine Made by Beyer, Peacock and Co., Ltd., Manchester, England

The wheels are set in alignment by poppet centers on the grinding head and tail-stock, a feature which insures the pin being ground parallel with the center line of the journals.

The machine is provided with countershaft, pumps and fittings. It will deal with pins up to 7½ in. diameter by 15 in. long, 9 ft. maximum distance over pins, and the supports will take wheels up to 8 ft. diameter with crank throws varying from 9 in. to 14 in. The Beyer, Peacock Company is now designing a crank pin grinding machine of similar type to the one, illustrated, to grind crank pins up to 9 in. in diameter.

Construction of the Street Locomotive Starter

IN the past numerous efforts have been made to utilize the auxiliary carrying wheels of the locomotive as well as the driving wheels as a source of tractive force. Recently this practice has become more general with the adoption of boosters acting either on the trailing wheels or on the tender truck. The most recent development in appliances of this type is the Street locomotive starter, originated by Clement F. Street, Greenwich, Conn., which was briefly described in the Railway Age of June 22, 1922, page 1710. The function of the starter is somewhat different from that of the booster as it is intended to assist the locomotive only when starting and is designed for use only at very low speeds. The method of application and details of construction of this device are clearly shown in the drawing.

The starter consists essentially of a heavy cast steel ratchet wheel pressed and keyed on an axle and driven by a steam cylinder. The piston of this cylinder is driven through its working or forward movement by steam pressure and through its return or backward movement by a spring. The piston rod has a crosshead on its outer end which engages a wrist pin carried by a pair of lever arms, which on their lower ends surround and are carried by a pair of collars formed on the ratchet wheel. A ratchet which engages the ratchet wheel is carried by and pivoted in the lever arms.

When the machine is idle and during the return stroke of the piston this ratchet is held out of contact with the ratchet wheel by a pair of springs attached to the lever arms. When steam pressure is admitted to the cylinder it passes through the hollow piston rod and through a hole in the crosshead to a small cylinder formed in the crosshead and forces the ratchet down into contact with the ratchet wheel and holds it there as long as the pressure exerted by the steam is greater than that of the springs which hold the ratchet up. The area of this small piston and the strength of the two small springs as well as that of the main spring are so proportioned as to result in the ratchet being forced down before there is any forward movement of the main piston and lifted before it begins its return movement. This arrangement eliminates any dragging of the ratchet over the ratchet wheel and the unnecessary wear and noise which would result if this were permitted.

Steam is admitted to and exhausted from the main cylinder through a piston valve embodied in the rear cylinder head and controlled by a small slide pilot valve which is operated by a stop on the piston rod. This construction has been in use for many years in air brake compressors.

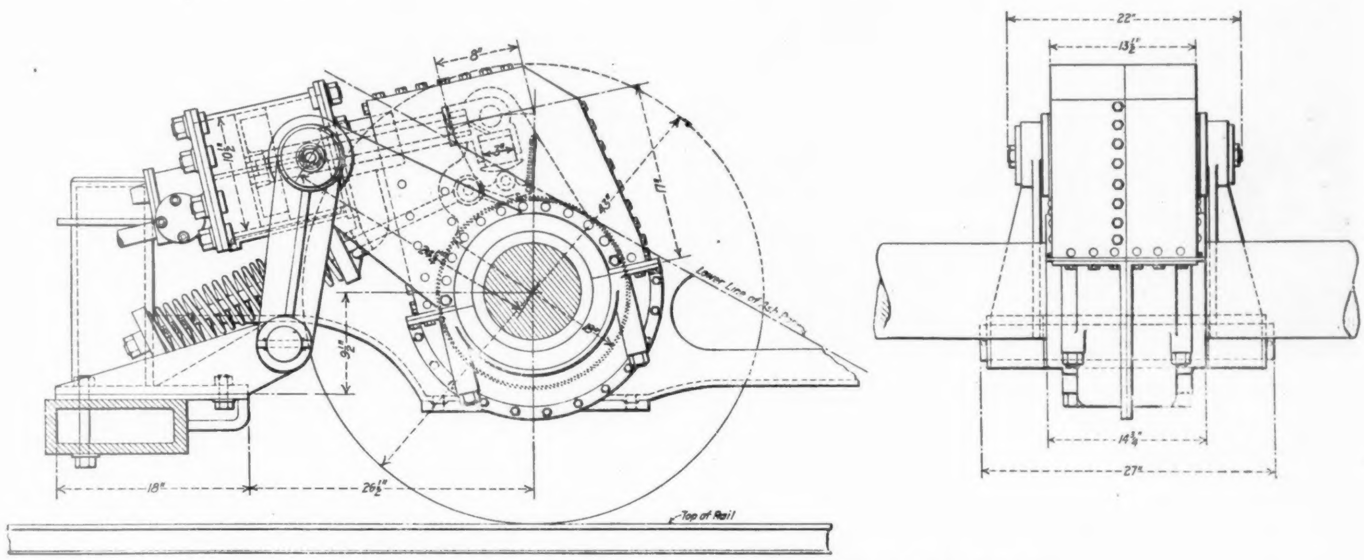
The weight of the forward end of the starter is carried by the axle through the lever arms and the weight of the rear end by the truck frame through a pair of cylinder supporting arms. The lower ends of these arms are carried by a pivot pin secured to the truck frame and their upper ends surround a pair of trunnions cast on the cylinder. These trunnions are tied to the axle through a housing which surrounds the entire front end of the machine. This method of supporting and tying eliminates any possibility of a spreading action between the truck frame and the axle and results in all strain transmitted to the truck frame by the starter being in almost a direct downward direction. As the only connection between the truck frame and the starter is pivotal it can move vertically in relation to the axle without hindrance or limit. Lateral movement of the axle is cared for by clearance between the hubs of the ratchet wheel and the lever arms. The casing is water and dust proof and carries lubricant for the bearing between the ratchet wheel and lever arms.

The face or bearing surface of the ratchet and ratchet wheel at the point of contact is four inches in width, the ratchet teeth are ¼ in. in depth and five in number.

The maximum pressure coming on these teeth is 32,000 lb. and while five teeth are provided, any single tooth has ample strength to withstand any strain which must be transmitted through this point.

The control mechanism has been reduced to the most simple form and consists of a one inch steam line leading from the dome of the locomotive to the cylinder of the starter with a throttle at the dome and a flexible joint at the cylinder. The throttle is opened and closed through the medium of a ¼ in. copper pipe leading from the throttle to a push button in the cab. When the push button is held down the machine will run and when it is released it will stop. This button can be operated by either the foot or the hand of the engineer.

A machine of this character must respond instantly when action is demanded and there is no time to wait for water to run out of pipes and cylinders. Therefore the throttle must be placed near the dome or source of steam supply and the cylinder and all steam passage must be free of water when the machine is not working. The Street starter has an automatic drain valve at the lowest point of the cylinder which remains open at all times when there is a pressure of less than about 10 lb. in the cylinder and closes automatically under any greater pressure. There are no pockets in the piping and when the throttle is opened the steam has an unobstructed passage to the piston. The throttle is of the double seated balanced type and is fully opened as soon as the button in the cab is pressed.



Side and End Views of Starter as Applied to Locomotive Trailing Axle

The starter exerts its greatest force when standing when it is needed most. It has no dead points and the tractive force exerted at the rim of the wheel is practically constant and the maximum permissible at all times when the machine is working.

The machine shown in the drawing is designed for application to a locomotive trailing truck having wheels 43 in. in diameter and carrying a weight of 52,500 lb. The tractive force exerted at the rim of the wheel with a 10½ in. cylinder and 200 lb. boiler pressure would be 12,900 lb. When making applications to trucks requiring more or less power than this the cylinder and piston are made of different diameter

but all other parts of the machine remain practically the same.

The machine illustrated is called the Type A; another smaller and less powerful, called Type B, is built for application to tender trucks. The starter is intended for moving a locomotive in one direction only, and if it is wanted for backing a second machine can easily be applied.

The device is primarily a locomotive starter and is cut out as soon as the train is well under way. In passenger service it will eliminate starting shocks resulting from taking slack. In freight service it will eliminate the need for taking slack in order to get a train under way and in so doing reduce break-in-twos, and draft gear and coupler failures.

Double Cutter Tool-Holders Withstand Tests

SOLID forged tools are superior to most inserted cutter tool-holders because the latter do not afford the same rigid support to the cutter point, and the heat conductivity of the tools is diminished. These defects, which prove serious on heavy turning and planing operations, are said to be overcome in the new line of tool-holders with interchangeable double cutters, made by the Morris Tool Company, Inc., New York City. Recently, various sizes of Morris tools were tested under actual working conditions in a prominent eastern railroad shop and found well suited to meet the severe requirements of this work. These tools, in the large sizes, will stand up under the heaviest wheel lathe

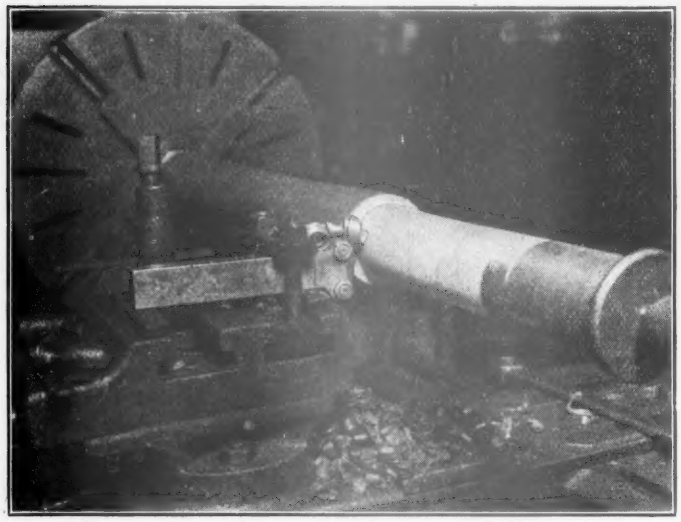


Fig. 1—Roughing Tool Taking 7/8-in. Cut on Car Axle

roughing cuts, and the small sizes are adapted to the finest toolroom work.

From Figs. 1 and 2, the general design of Morris double-cutter tools will be evident. The double cutter, made of scientifically heat-treated high-speed steel, is firmly secured to the heat-treated chrome-nickel holder by two bolts and nuts.

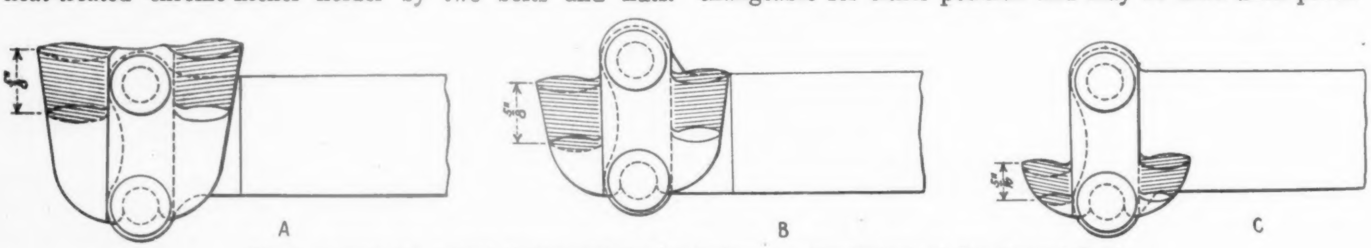


Fig. 2—Morris No. 6 Tool-Holder and Double Cutter, the Equivalent of Six Forged Tools

These bolts, also of heat-treated chrome-nickel steel, unite the cutter and holder firmly and intimately so that they are virtually one as regards support and conductivity.

The side and front angles of the double cutter are always correct, as fixed by the manufacturer, and sharpening is accomplished by grinding the top surface at the required angle. Allowing 1/32 in. for each grinding, the cutter can be ground 20 times on each side, as shown at *A*, Fig. 2, giving a service equivalent to that of two forged tools. Twenty more grindings on each side, equivalent to two more forged tools, can be made, leaving the cutter worn away as shown at *B*. The tool is used finally, as shown at *C*, as a draw stroke or goose-neck planer tool, obviously of efficient design for this work. Ten grindings can be made on each

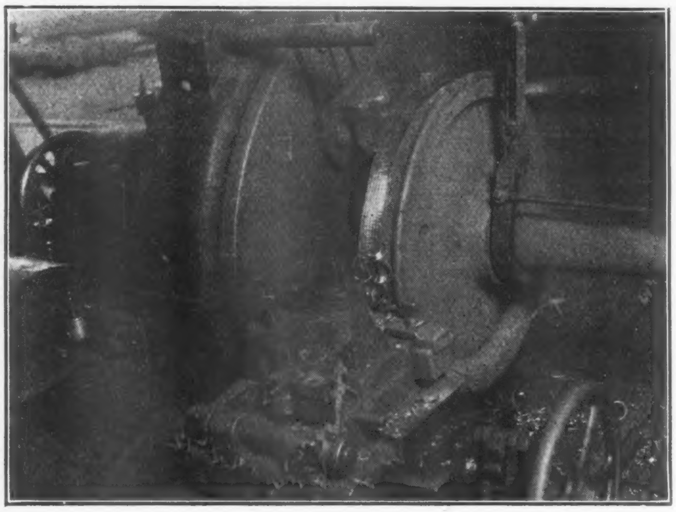


Fig. 3—No. 18A Roughing Tool Used in Sellers Car Wheel Lathe

side of the draw stroke tool and a total of 100 grindings is therefore obtained on one No. 6 double cutter (more on larger sizes), equivalent to six forged tools.

Morris tools are made in 13 sets (No. 2 to No. 18B), the tool-holders varying from 1/4 in. by 1/2 in. by 4 in., to 2 1/2 in. by 3 in. by 24 in. Tool No. 18A is 1 3/4 in. by 3 in. by 22 in., being made to fit the turret tool post of a Sellers car wheel lathe. The blade thickness varies from 1/8 in. to 1 1/8 in. The tool-holders are made with straight and offset shanks and, being reversible, one offset shank provides for both right-hand and left-hand positions. Threading, cut-off and side tools are also furnished. The cutters are interchangeable for either position and may be used until practically ground down to nothing at the cutter point, thereby economizing on high-speed steel. A unique feature is the vertical offset of the cutter holding bolts with respect to the holder center line which, by turning the tool-holder over, provides for adjusting the cutting point to the proper height as it wears down. Another important feature is that tool dressing expense is eliminated, the cutters being purchased from the manufacturer who makes them in quantity and

naturally knows what heat treatment will give the best results.

In the railroad shop tests referred to, the No. 12 tool, illustrated in Fig. 1, was first used in roughing down a 6-in. steel engine truck axle. The lathe was driven by a belt which started to slip before a fair chip could be taken. The belt slack was then taken up and a roughing cut taken, as illustrated. The reduction on the axle in this case was 1¾ in., the depth of cut being ⅞ in. and the feed 1/16 in. A speed of 50 ft. per min. was maintained. At the highest capacity of this belt-driven lathe the tool showed no signs of distress.

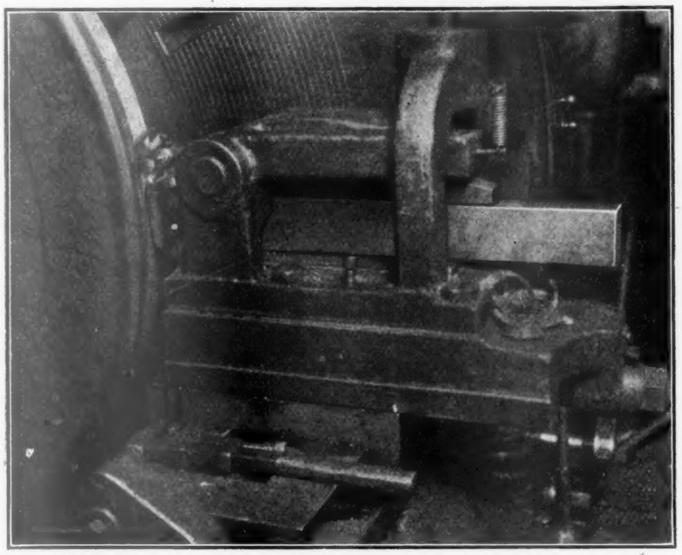


Fig. 4—No. 18AA Roughing Tool in Driving Wheel Lathe

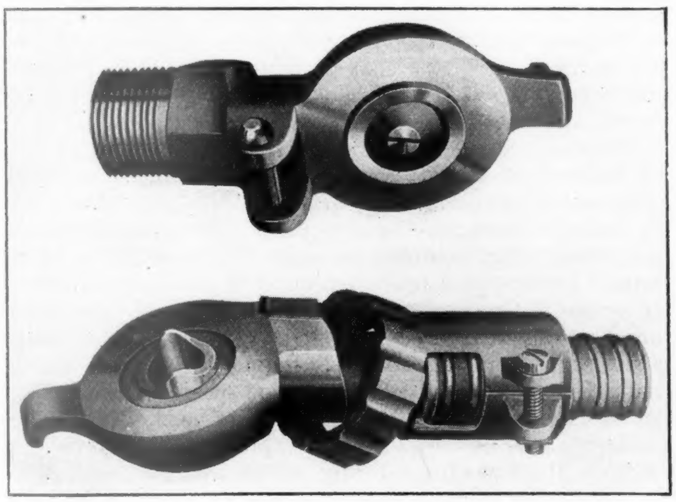
In Fig. 3 a No. 18A tool was put in the car wheel lathe and a pair of 36-in. steel car wheels applied ready for turning the tires. On the roughing cut, a feed of ⅜ in. was used, the depth of cut being ½ in. and the speed 11 ft. per min. The roughing cut was taken up to the flange and the flange turned to the proper height in 15 min., two roughing tools being used and two tires turned at the same time. These tires were finished with the usual forming tools held in the wheel lathe turret, 10 min. being required to finish the tire. With 3 min. for applying the wheels in the lathe, the total time from floor to floor was 28 min. This was quite a severe test of the tool, the chips coming off a deep blue and indicating the severe duty which any tool must stand to cut under the crystallized tread of a steel car wheel.

A No. 18AA Morris tool (2 in. by 3 in. by 22 in.) was tested in the big driving wheel lathe on a pair of main drivers, as shown in Fig. 4. A feed of ⅜ in. was used, the depth of cut being approximately ⅜ in. on this pair of wheels and the surface cutting speed 11 ft. per min. Forty minutes were required to take the roughing cut across both tires. While the cut in this case was not very deep, due to small wheel mileage and wear, at ⅜-in. feed the Morris tool is said to take whatever depth of cut may be necessary to restore the normal tire contour.

Air Hose Coupling with Automatic Stop Valve

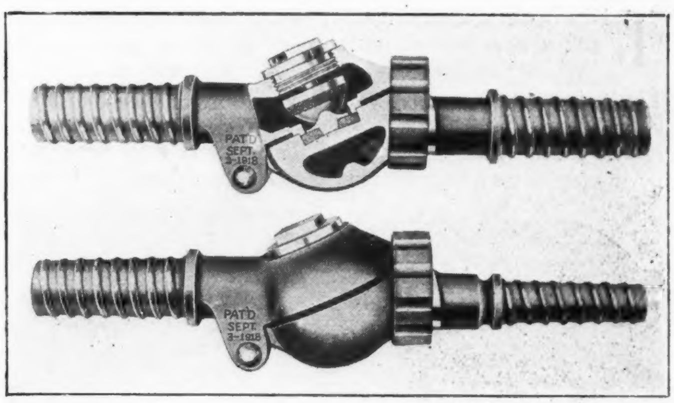
A SHOP air hose line coupling, one half of which is automatically closed by a check valve when the coupling is separated, is being placed on the market by the Robinson Machine Company, Muskegon, Mich. The coupling is made for use in hose lines or for connecting hose to the permanent pipe line.

In the latter case, the pipe line half, which contains the automatic check valve, is machined and fitted with a valve cap opposite the connecting face. The valve consists of a brass stem fitted with a specially treated leather disc facing, which is easily replaced without the use of special tools. The valve stem is centered in a reamed hole in the valve cap. The pressure of the air acts on the top of the valve, causing it to close automatically when the couplings are separated and keeping the opening tightly sealed as long as the pressure continues. Two lugs project beyond the face of the coupling at its hose or pipe line connection end, which serve to protect the seat when the coupling is being dragged along the floor at the end of a hose. These lugs are connected by a pin under which the hook on the end of the other coupling half is inserted when making a connection.



View of Coupling Showing Automatic Stop Valve

The other half of the coupling has two small projections on opposite sides of the port opening. When the coupling is made these projections push the valve open, automatically admitting air to the hose line. The face of this half of the coupling is recessed to receive a specially treated gasket which is cemented permanently in place. These gaskets under severe tests in actual operation have held up for from six months to one year. When the connection is made the two halves of the coupling are locked together by an eccentric clamping ring on the hose shank by turning the ring in either direction from a central position.



Coupler or Hose Connections Showing Shanks for ½ and ¾-in. Cylinders

For use in hose lines both halves of the coupling are made

with hose shanks. All hose couplings are fitted with a positive grip clamp which eliminates the tendency for the coupling to blow out of the hose line.

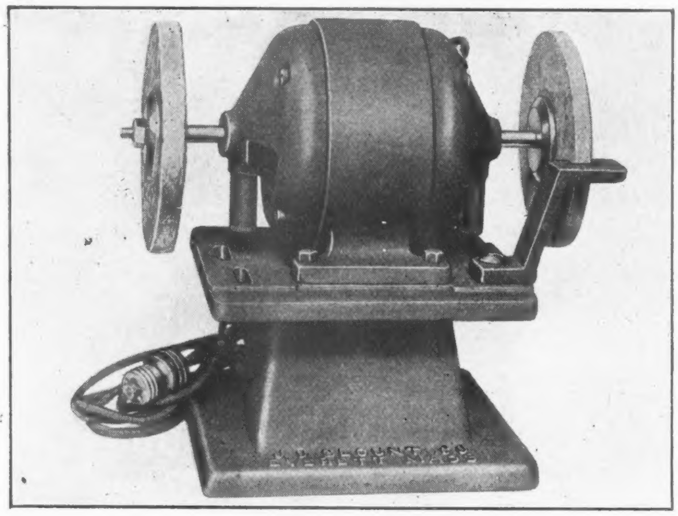
By using this type of coupling on the termini of service pipe lines, it is said to be unnecessary to employ a globe valve for shutting off the air. The check valve in the coupling closes automatically when the hose line is disconnected and maintains a tight joint as long as the air pressure is on. The use of these couplings thus saves considerable time in connecting and disconnecting pneumatic tools from the hose line, since it is unnecessary to leave the work to open and close a valve at the end of the pipe line. By closing the line at the point where the connection is to be made they also eliminate the loss of air pressure contained in the hose line.

Bench Type Motor Grinder and Buffer

Designed to operate on either alternating or direct-current circuits, a new combination motor grinder and buffer of the bench type has been developed by the J. G. Blount Company, Everett, Mass. This machine is provided with so-called Blount special plain bearings and a standard Westinghouse single-phase, $\frac{1}{4}$-h.p. motor designed to run at 1,800 r.p.m. The machine runs on alternating current, either 110 or 220 volts, 60 cycle, or single-phase. Thirty-two, 110, or 220-volt direct current can also be used as desired.

A substantial base is provided for this machine, of ample strength and weight sufficient to minimize vibration. The flanges are machined all over to insure balance. The grinder has a pan to support the guards and rests. The guards can be furnished for either side for use with grinding wheels and an extra rest for the left side if it is required. The buffing wheel is of the standard make and is placed on the left side of the machine. The equipment furnished with this grinder consists of one 6-in. by $\frac{1}{2}$-in. standard grinding wheel, medium grit; and two rests for right-hand side; one 7-in. by $\frac{3}{8}$-in. buffing wheel (sewed); and attaching cord with standard plug.

This combination grinder and buffer is a convenient bench tool, being adapted to use in almost every department of railroad shops. For grinding tools, small castings and small machine parts, also for buffing operations it should prove convenient and adaptable, saving considerable hand work.

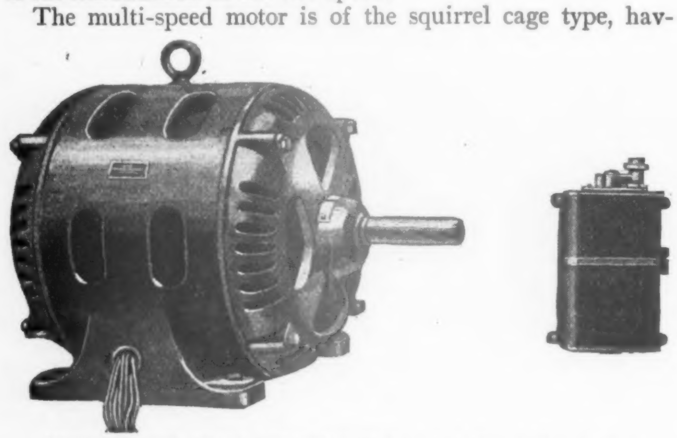


J. G. Blount Bench Type Motor Grinder and Buffer

Multi-speed Alternating Current Motors

The Louis Allis Company, Milwaukee, Wis. is announcing a new line of multi-speed induction motors which provide for speeds of 600, 700, 900 and 1,200 r.p.m. The principal point of distinction claimed for these motors is the introduction of the 720 speed.

The multi-speed motor is of the squirrel cage type, having a rotor similar in construction to that of the standard single speed polyphase squirrel cage motor, manufactured by the same company. The external appearance of the motor is identical with that of the standard induction motor except that additional leads are brought out from the several stator windings. The motor is built for either two, three or four speeds. A separate stator winding is used for each speed, giving approximately the same operating characteristics as the squirrel cage motor running at this particular speed. As each stator winding is independent of the other, the winding may be designed for any required horsepower at that speed, providing the capacity for that particular motor frame size is not exceeded. The motors are designed for constant horsepower, constant torque or any combination of both.



Watson Multi-Speed Induction Motor and Drum Controller

The standard single speed squirrel cage motor when wound for three phase current has three stator leads. The multi-speed motor has one common lead and two leads for each of the various windings. The changes in speed are accomplished by a simple drum controller for either two, three or four-speed motors. In the case a two-speed motor is used for non-reversing service it is only necessary to provide a three-pole double throw knife switch for speed changing. The drum controller is so designed that any selected winding of the motor may be connected to the line giving the desired speed. The windings not in use at any particular moment are open. The manufacturer states, however, that no appreciable voltage is generated in these windings during this period.

The starting or protecting device used with the multi-speed motor may consist of any standard or automatically controlled switch which is adapted to a single speed squirrel cage motor. In the case of a constant horsepower multi-speed motor which has the same horsepower rating at all speeds, one set of overload relays on the starter will afford protection throughout the complete speed range. With a constant torque multi-speed motor it is necessary to supply an additional set of relays

for each stator winding, if overload protection is to be provided at all speeds. The speed changing device which may consist of a knife switch or drum controller is a separate unit of control and except in the case of automatic control is used for speed changing only. The manufacturers offer several different types of automatic control for these motors consisting of the drum controller and an automatic starting panel. For automatic control, the drum is provided with auxiliary contacts which actuate the starter at the proper intervals.

The motors are built in sizes of from 3 to 15 hp. and are built for either three-phase or two-phase current with one exception. Two winding four-speed motors in which the speed changes are accomplished by polar grouping are suitable for three-phase operation only.

Electric Sifter with High Capacity

A FORWARD step in foundry practice is taken with the advent of an electric sifter made by J. D. Wallace & Co., Chicago. The Wallace electric sifter is said to sift a ton of moist molding sand in four minutes through a No. 2 riddle, delivering the sand perfectly cleaned and thoroughly mixed. The light weight of the sifter permits it to be hung from any convenient support at any desired height and a molder can easily move it over his sand pile, or sift directly over core trays or flasks. The greatest vibration is only 5/16 in. from its vertical position. The drive is by means of a special electric motor connected direct to the riddle. The motor is a vertical General Electric motor in which the armature and shaft remain stationary and the field and housing revolve at high speed. The housing, being weighted on one side results in an extremely rapid and regular vibratory motion similar to that of an eccentric fly-wheel.

Wallace Sifter Driven by Special Electric Motor

This motor is enclosed in a dust and grit proof casing and cooling air is circulated around the motor by its own peculiar motion. The air is drawn in at the top of one arm of the supporting frame tubing and after circulating around the motor is expelled at the top of another arm. A valve trap at the air intake prevents dust and dirt entering the motor.

The machine comes equipped with an 18-in. riddle with No. 2 screen which can be readily changed or removed by simply loosening the riddle clamps. The Wallace electric sifter should prove of value in railroad iron or brass foundries because of its time- and labor-saving features, coupled with portability, light weight and sturdy construction.

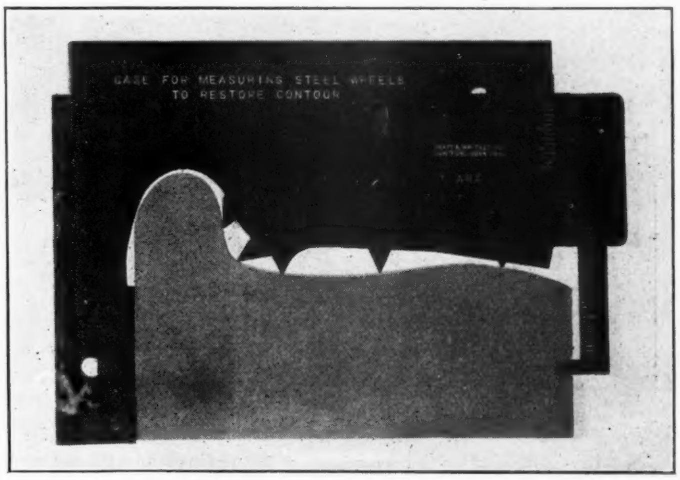
Gage for Measuring Steel Wheel Wear

A GAGE for measuring the wear on steel wheels, adopted as a standard by the American Railway Association in 1920, is now being manufactured by the Pratt & Whitney Company, New York. This gage, as shown in the illustration, gives a direct reading of the amount of service metal on a steel, or steel-tired wheel as the basis for billing foreign roads for wheel replacements according to the Interchange Rules. It tells whether or not a worn wheel is worth re-turning to restore the standard contour, and the amount of service metal which will remain after turning. This measurement can be made either before or after turning as desired.

The gage can be set to the wheel in a dark place if necessary, and then taken to the light for reading, thus avoiding errors and guess-work. The witness groove (limit of wear groove) should be checked to insure that it is of the right diameter—29½ in. for a 33-in. wheel. The contour should also be taken at several points so that the point of maximum wear may be found.

As shown in the illustration, this gage consists of a main frame to which a sliding front plate with a standard tire contour is fitted. The position of the front plate with respect to the main frame is indicated by the upper scale. The distance from the tread to the witness groove is indicated by the sliding scale and pointer shown at the right. Four adjustable sliding pointers are arranged to make contact with the worn tire, as plainly shown in the illustration.

In using this gage it is applied over the worn tire with the sliding pointer swung to engage the witness groove, as illustrated. The four sliding pointers are pushed down to contact with the tire and the gage is then removed for



Pratt & Whitney Gage Applied to Worn Tire

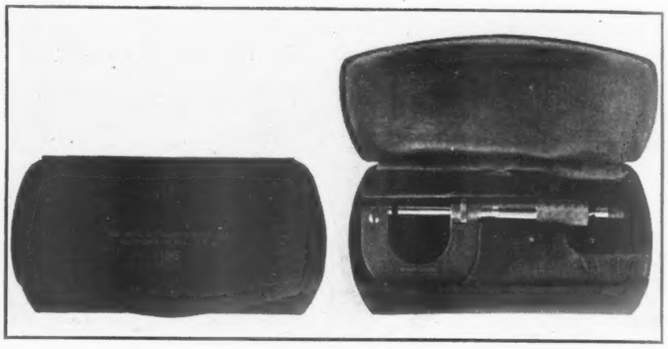
reading. The sliding front plate is moved down until its lower edge coincides with the lowest point of the four sliding pointers. The amount of metal which must be removed to restore the standard contour will then be indicated on the upper scale. The amount of service metal remaining will be indicated on the sliding scale.

Leather-Covered Metal Pocket Micrometer Case

A POCKET micrometer case is being placed on the market by the Brown & Sharpe Manufacturing Company, Providence, R. I., in connection with this company's line of micrometer calipers. This case protects the micrometer from dirt and injury and is serviceable and handy. It represents a new departure in micrometer cases and is well adapted for the purpose intended. It is made of metal, leather covered and plush lined, and its shape adapts itself for the pocket so that it takes up very little room.

The illustration shows the case at the left closed and at the right open with a micrometer inside. Two styles of pocket micrometer cases are furnished for the regular Brown & Sharpe 1-in. micrometers and for the Rex 1-in. sizes. Men who own micrometers will be interested in this case as it offers a good protection for the micrometer and a handy place to keep it.

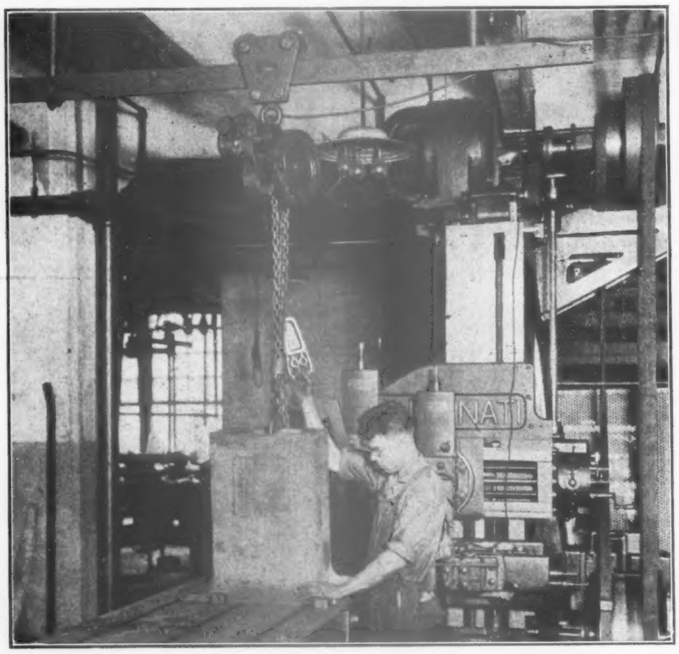
Good tools are essential to accurate work and if there is one thing which distinguishes an experienced, reliable workman from an indifferent one, it is the care with which the former looks after his tools and keeps them from dirt and injury.



Browne & Sharpe Pocket Micrometer Case

Electric Motor-Driven Chain Hoist

AN electrically-operated material-handling device, known as the Motorbloc, has been placed on the market by the Motorbloc Corporation, Summerdale, Philadelphia. This device has been developed to serve the operations lying between the field of standard hand chain hoists and traveling electric hoists. The Motorbloc is a rugged and readily portable hoist, which can be installed without engineering preliminaries in any location where electric current is available. It is put in service with the facility of an electric drill or vacuum cleaner, and the self-contained pendant controller permits convenient operation as soon as the cord has been plugged into the nearest electric circuit.



Motorbloc Hoist As Used in Machine Shop

In the design, great care has been used to avoid stressing the hoisting mechanism beyond the loads and speeds for which it is proportioned for hand operation.

The Motorbloc consists of a standardized chain hoist of steel construction, electrified by the application of a specially designed heavy-duty motor, liberally proportioned reduction gearing and slip friction clutch. This mechanism is applied by means of a malleable iron supporting bracket, comprising a self-contained electrifying unit, to which the pendant controller is also attached. In this way a simple, rugged mechanism has been developed for the electrification of the standard spur-geared chain hoists in capacities ranging from ¼ to 10 tons.

Extreme care has been given to features of compactness, symmetry and balance, combined with lightness and strength through the use of high grade materials, liberally proportioned to meet the most severe service conditions. The armature shaft and worm are carried in heavy duty ball-bearings and liberal provision has been made for adequate, automatic lubrication.

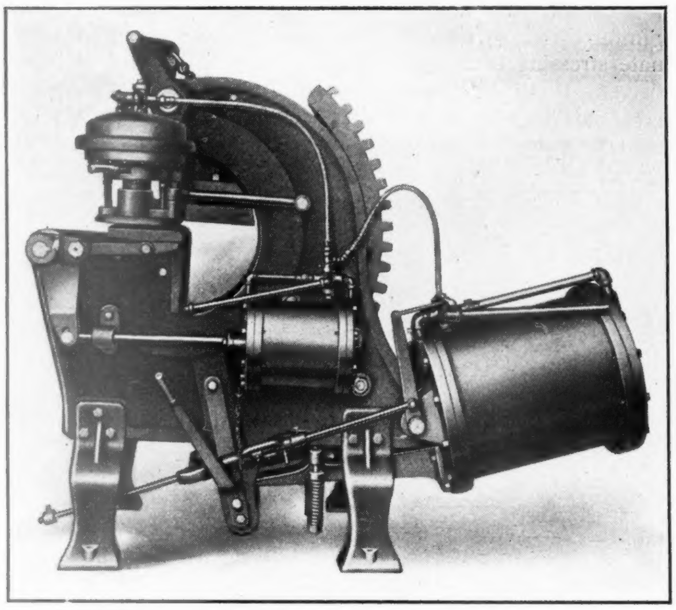
The self-contained pendant controller is easily operated by the fingers of one hand, leaving the other hand free to guide the load. This arrangement makes it possible for one man, without physical effort, to accomplish what would otherwise require two or more men for lifting and placing the same load.

The simplicity of this mechanism is promoted and the operation safeguarded by the use of the ring-oiled slip friction clutch which prevents damage from over-running to the hoist parts and chain and at the same time completely protects the motor from overload, without the complication of an electric limit switch.

The illustrations show the Motorbloc built on a Franklin-Moore all-steel suspension spur-geared chain hoist. For occasional use at points where electric current is not available, or in the event of the temporary failure of electric power, the hand chain can be quickly applied, and the hoist operated as an ordinary block.

Heavy Type Pneumatic Flanging Machine

THE pressing demand for a pneumatic flanging machine which would successfully flange the heavy plates now being used in the construction of locomotives, prompted the McCabe Manufacturing Company, Lawrence, Mass., to build a heavy type machine shown in the illustration. This machine will flange cold any thickness of boiler plate up to and including ¾ in. Circular heads, half heads, dished heads, segments of circular heads and straight flanging are flanged cold. Corners varying from 1¼ in. radius to 8 in. radius are flanged in one heat and with one complete stroke of the bending ram.



New McCabe Machine Which Flanges ¾-In. Boiler Plate Cold

The new McCabe flanging machine is equipped with a patented pneumatic plate clamp. This clamp eliminates most of the manual labor that was required in the former models. By adopting this new clamping device, the speed of flanging circular work has been increased over 50 per cent. The machine is of cast steel construction; is self-contained; requires no foundation; and can be operated anywhere about the shop within range of the air system. All that is required to put the machine into operation is an air hose (100 lb. pressure) and a jib crane for handling the plates. Light plates can be supported by hand but for heavy work the jib crane is practically indispensable.

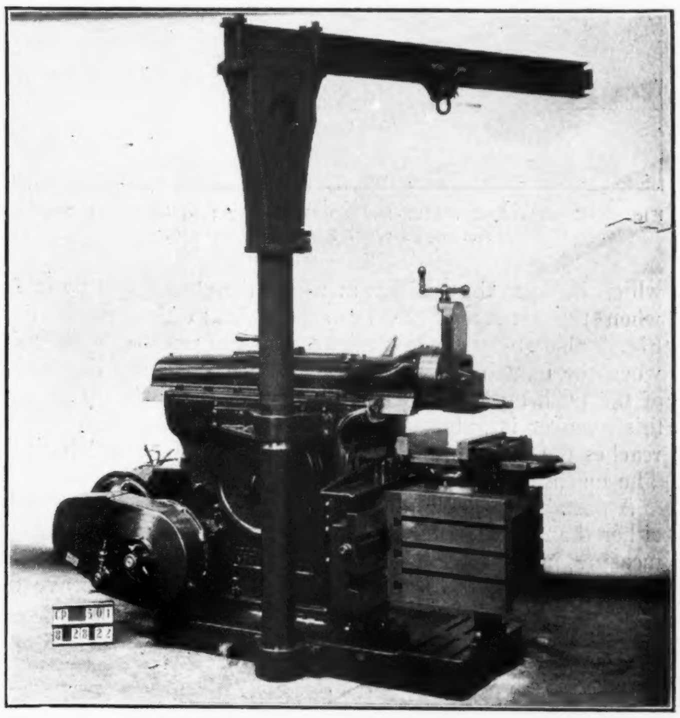
The advantages claimed for previous models are retained in this machine and include ability to flange similar pieces with uniform accuracy, convenience of moving from one part of the shop to another, or from one job to another, flexibility so as to handle various steel-plate shapes used in locomotives and car repairs, coupled with ease of operation. There are two operating levers, one controlling the pneumatic clamp or locking arrangement and the other controlling the movement of the piston which in turn moves the flanging arm.

Jib Crane Applied to Crank Shapers

FOR greater convenience of handling heavy parts to be machined, Gould & Eberhardt, Newark, N. J., have brought out for their shaping machine a simple but substantial jib crane as illustrated. This eliminates the need for overhead cranes, and shapers equipped with the jib crane can therefore be placed wherever is most convenient without regard to overhead crane location. The jib crane is attached to the shaper in the most efficient location, being opposite to the operating side of machine. The machine being direct driven makes it possible to revolve the crane completely around and handle all work which lies within its range.

The design and capacity of the crane is such that it is self-supporting and will handle the maximum weight of work that the machine can accommodate. It also has valuable structural features, including a boom composed of a single I-beam of the required strength to safely provide for a load of 1,000 lb. at its extreme end; a mast of heavy wrought steel pipe securely clamped against the frame at two positions, thus distributing the load to the shaper frame more equally, and an upper pintle of cast steel, rigidly held in a cap attached to the mast and having the ball and socket type bearings which insures proper alinement of the boom at all times, thus making it possible to revolve the crane with a slight pressure.

The machine, as shown, is of modern design being both powerful and compact, and having all levers within easy reach from the operating position. The new start and stop lever is arranged in a convenient location and permits the operator to start or stop the machine while remaining close to the work being done. Single pulley drive is provided; also selective type gear boxes which have all gears heat treated and running in heavy oil. By means of the patented double train gear drive combined with the selective type gear drive, eight changes of speed for every stroke ranging from 9 to 115 strokes per min. are possible. This feature makes the shaper especially adaptable to use in machine shops where a variety of work is done.



Jib Crane of 1,000-Lb. Capacity Applied to Gould & Eberhardt Shaper

Chambersburg Punching and Shearing Machines

VERTICAL punching and shearing machines, with settings and adjustments of the sliding-head stroke quickly made by means of a patented electric clutch control, have recently been developed by the Chambersburg Engineering Company, Chambersburg, Pa.

A direct motor-driven double-end machine, equipped with the electrical control, is illustrated in Fig. 1. This line of equipment is so designed that machines of different capacities may be operated end to end, as well as machines of like capacity. Belt-driven machines may also be provided with a mechanical pedal control, as illustrated in Fig. 3, instead of the electric control. However, this control is recommended to be used only when proper electric current is not available.

Rapid Stroke Adjustment

The stroke adjustment is made at the head end of the machine when the control head *A*, Fig. 2, is in the adjusting position shown, at which time the electric circuit has been automatically opened, and the clutch disengaged. The stroke adjustment is then made by positioning around cap *B*, a headless set-screw which is exposed. Cap *B* has graduations

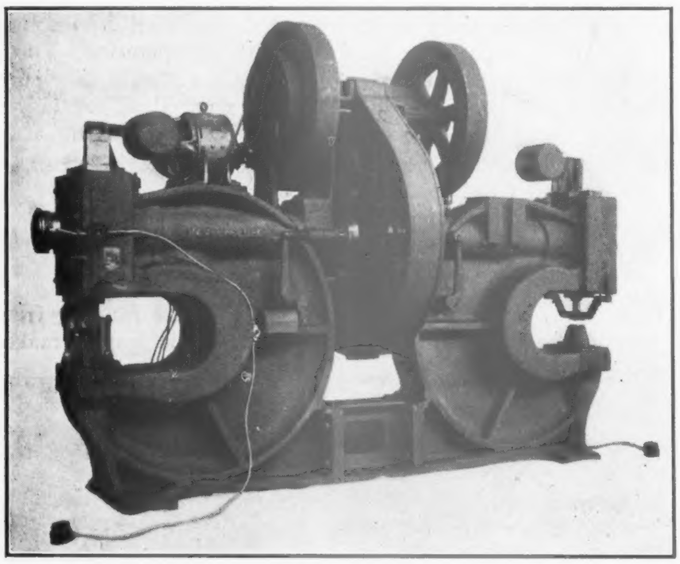


Fig. 1—Double End Motor-Driven Punching and Shearing Machine Arranged with Electrical Control

which indicate the position at which the stroke will be ended when the set-screw has been brought to that graduation. Fig. 2 also shows the control head in the position it occupies when the machine is in operation. A momentary depression of the push-button causes the engagement of the clutch, and this member is automatically disengaged as the sliding head reaches the point indicated by the setting of control head *A*. The machine may also be operated continuously.

A portable push-button switch is provided for operating by either hand or foot. The clutch disengages as a safety measure in case the electric circuit fails. With this automatic control it is unnecessary for an operator to leave the front of the machine while punching or shearing work.

Arrangement of Clutch

The clutch is of the solid-jaw renewable-face type. The sliding half is a steel casting and the fixed half is cast integral with the large gear and reinforced by a steel ring shrunk into place. The machine frame is an I-beam type semi-steel casting with a solid jaw. The sliding head is also a semi-steel casting and has a bronze take-up wedge. The eccentric shaft is a one-piece steel forging, accurately finished, which rotates in large bronze bushings. The main bearings and the sliding head are lubricated by sight-feed oil-cups, and oil-grooves provide for the efficient distribution of the oil.

The machine-molded gears are made of semi-steel, the pinion being shrouded. Fractional ratios insure the alternate stressing of the gear teeth. When a machine is motor-driven, a cut steel gear is furnished on the motor shaft. Gear guards may also be supplied. A one-piece safety capstan provides for turning the eccentric shaft by hand, and

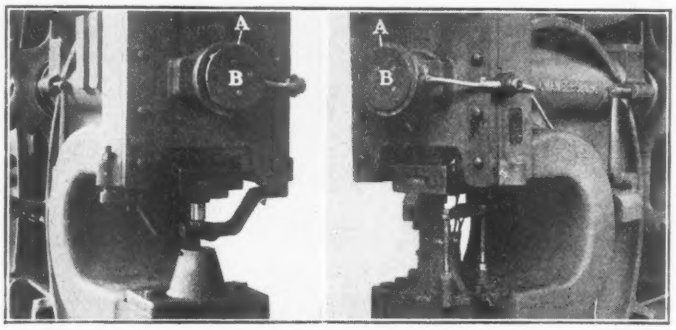


Fig. 2—Control Head in Adjusting Position on Punching Machine (Right) Shearing Machine with Control Head in Operating Position

for camming the capstan bar out of the capstan, should the machine be accidentally started. The driving shaft is turned from machine steel, and runs in babbitted bearings. The tool-blocks are made of cast steel, the upper block being tongued to the sliding head and the lower block bolted to the frame. All tool-blocks are interchangeable on machines of like capacity. A patented floating punch which combines a fixed and a floating punch in one tool facilitates spacing

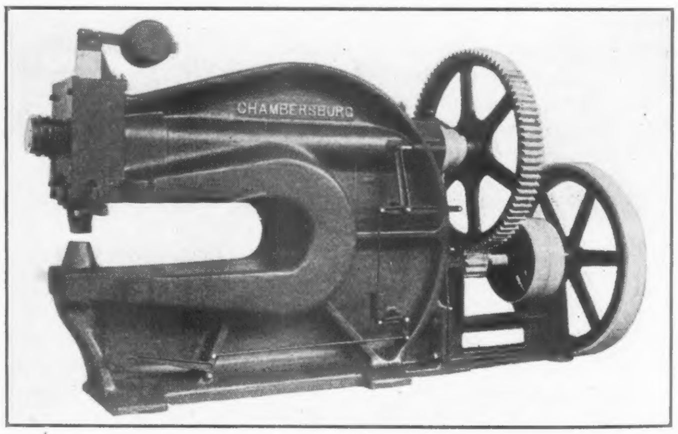


Fig. 3—Single End Punching Machine with Mechanical Control and Belt Drive

table work. A tool-block can be removed in an instant by a quarter turn of a handle.

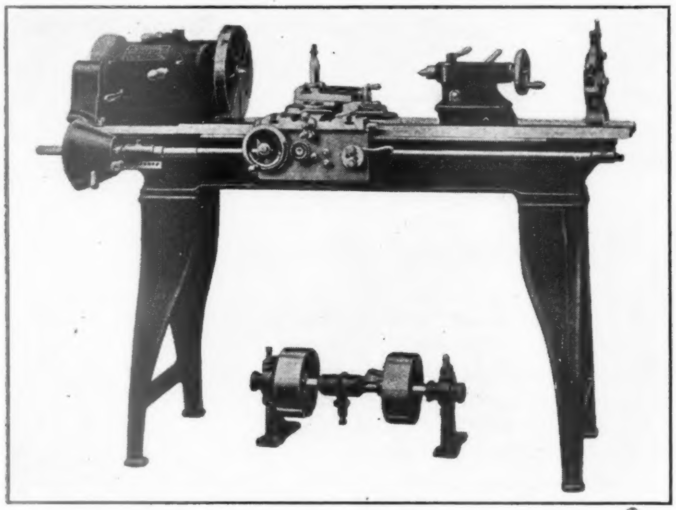
Eight Sizes of Machines Made

This line of machines is made in eight sizes, the smallest of which has a capacity for punching a $\frac{5}{8}$-in. hole through mild steel plate $\frac{1}{2}$ in. thick; shearing 3-in. by 9/16-in. flat stock, $1\frac{1}{8}$-in. round stock, and 2-in. by 2-in. by 3/16-in. angle-iron; and splitting plate up to 7/16 in. thick. The standard throat dimensions are made 6, 12, 18 and 24 in. The largest size machine has a capacity for punching a $2\frac{1}{2}$-

in. hole through mild steel plate 1 in. thick; shearing 8-in. by 1¼-in. flat stock, 2½-in. round stock and 6-in. by 6-in. by 11/16-in. angle-iron; and splitting plate up to 15/16 in. thick. The standard depths of throat for machines of this size are 15, 24, 36 and 48 in., which sizes provide for covering an extremely wide range of work.

New Sizes of Engine Lathes Brought Out

UNTIL recently the Oliver Machinery Company, Grand Rapids, Mich., confined its engine lathe line to sizes from 16-in. to 30-in. swing inclusive. These lathes are now made, however, in 10, 12 and 14-in. sizes, the 12-in. lathe being illustrated. The new machines are versatile, being adapted to a wide variety of turning, threading and screw cutting operations.



Oliver 12-In. All Steel Geared Head Engine Lathe

Cone pulley or all-steel geared head stocks may be furnished, and either belt or motor drive. The single pulley drive geared head stock is of the enclosed box type, fitted with steel gears running in oil. All head stocks are equipped with a positive tooth feed reversing clutch by means of which both the longitudinal and cross feed and the direction of the lead screw may be instantly reversed. This can be accomplished without engaging or disengaging gears, stopping the lathe, shifting belts or reversing the spindle rotation. This feature greatly simplifies the cutting of threads and decreases the time of operation. Thoroughly tested and valuable features of construction are included in the carriage, apron and taper attachment. The latter can be readily applied later if not specified when the lathe is purchased.

The 12-in. lathe, illustrated, has an actual swing over the bed of 13 in. and over the carriage of 9 in. Thirty-six inches is provided between the centers and all standard thread from 3 to 40 per in. can be cut. The feed range is from .0025 to .039 in. per revolution. Six spindle speeds can be obtained from 25 to 500 by means of the patented selective quick change gear box. The 12-in. machine with a 5-ft. bed weighs 875 lb. crated.

Simple Rugged Construction Feature Electric Hoist

AN electric hoist of substantial but simple construction, handling loads up to 1,000 lb. and known as the Load Lifter, has been developed by Alfred Box & Company, Inc., Philadelphia, Pa. This hoist has a lifting speed without load of 30 ft. per min.; with 500-lb. load, 32 ft. per min., and with 1,000-lb. load, 20 ft. per min. The standard lift furnished is 15 ft., the maximum being 39 ft.

Many advantages are claimed for this electric hoist, among which may be mentioned automatic lubrication from one point. By an ingenious combination of the splash and force feed system, it is only necessary to pour oil into the housing at one point and then only about once in six months. All operating parts are enclosed and the unit is highly efficient due to the use of flexible and self-alining ball bearings throughout. The lack of complicated mechanism eliminates the necessity for adjustment after installation. Improved load brakes control and hold the load automatically, and the load may be moved a fraction of an inch in either direction by proper co-ordination of brakes and controller. This is provided for automatically so that the hoist may be safely operated by any person. The controller is of rugged construction and totally enclosed in a water-proof housing.

The Load Lifter takes up little more space than the ordinary chain block. Adjustable trolleys are provided and an interchangeable upper hook and trolley. Any Load Lifter may be easily converted into either hook or trolley suspension, the two types being interchangeable. To prevent overwinding of the hoist hook and subsequent damage, an improved upper safety stop shuts off the current from the motor and applies the band brake so that the hoist instantly stops. The rope may be readily removed from the winding drum but, on account of deep flanges, cannot come off the drum accidentally or become wedged between the drum and the frame. A totally enclosed one horsepower motor, built especially for severe hoist service, is used in this electric hoist.

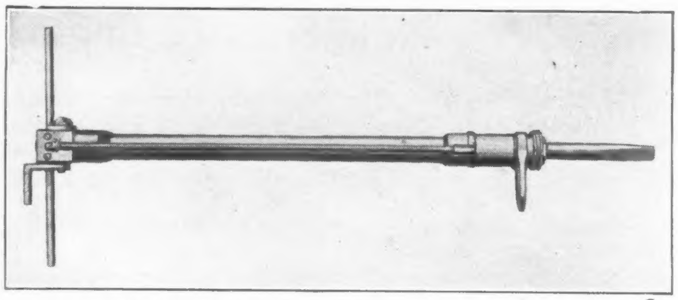
Simple Compact Electric Hoist; Capacity Up to 1000 Lb.

Rivet Cutter Designed to Obviate Plate Distortion

ON the principle that when cutting rivets, a number of comparatively light, rapid blows cause more vibration and therefore more distortion of steel plates than a few intermittent, heavy blows, the Chicago Pneumatic Tool Company, New York, has designed and manufactured a new type of rivet cutter known as the Boyer Superior.

In construction it consists of a dead handle, a throttle handle of the crank design, a throttle valve of the taper type, a back head screwed onto the cylinder and secured by a locking device, a cushion chamber in the rear end of the cylinder, a cylinder of seamless steel tubing, a bypass from back to front head, a non-removable electrically-welded front head, square coiled spring buffer, adjustable chisel lock, hand hold of the spade handle type, and chisel.

To operate, the throttle handle is moved in a line parallel with the cylinder. Each forward and return stroke of the piston is hand controlled. About four blows, requiring approximately 10 to 15 sec., are said to be required to cut off the head of a 3/4-in. rivet. Two men are required to operate the machine. It is designed to be used wherever rivets are cut, and is especially adapted to steel car repair work.

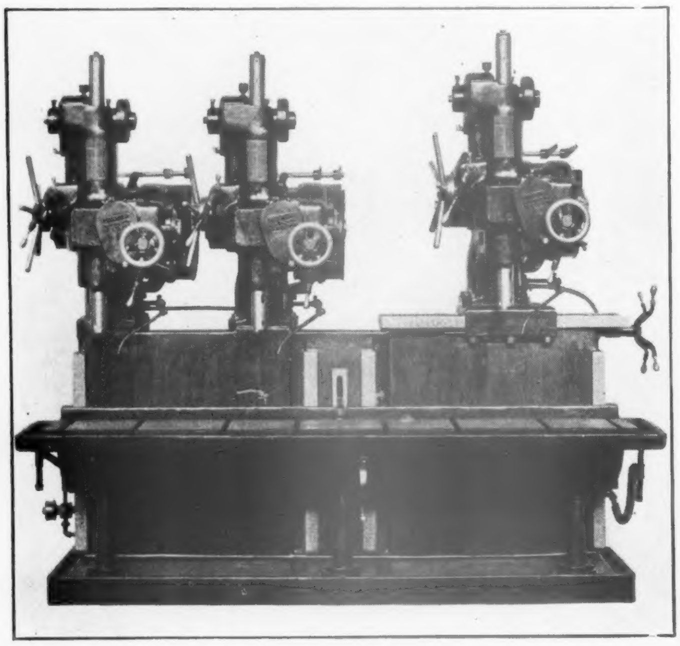


Boyer Superior Rivet Cutter for Boiler and Steel Car Repair Work

Special Gang Drill with One Moving Head

A SPECIAL gang drill has been developed recently with longitudinal movement for the right-hand spindle, as shown in the illustration. A four spindle column is used and regular four spindle table. The two left-hand heads are permanently placed on the column and have a fixed center distance. Head No. 3 is mounted on a plate having finished ways, this plate being attached to the column.

The third head has a horizontal adjustment of 27 in. and is moved by means of a screw and capstan handle. Provision is made for clamping the head securely in any desired position. The minimum center distance between the second spindle and the adjustable spindle is 27 in. The maximum distance is 54 in. The minimum distance betwteen the extreme left-hand head and the adjustable head is 54 in. and the maximum distance is 81 in. Thus the total range between spindle centers is 27 to 81 in. Instead of having the finished ways extending only half the length of the column they can be lengthened and extend under the second spindle if desired. A fourth head can also be mounted on the finished ways so as to make a regular four-spindle machine with 27-in. center distances between the spindles. The machine illustrated is a Colburn No. 4 drill press, but the smaller No. 2, or larger No. 6, can be arranged similarly.



Colburn Heavy Duty Multiple Drill Press With Horizontal Adjustment for One Head

The driving and feed gears of this drill press are mounted inside of each head and run in oil. The gears are made from chrome nickel steel, hardened and heat treated. The shafts are of large diameter and mounted on ball bearings. Automatic trip is provided. The spindles are double splined to equalize the strain and each spindle has a drilling capacity of 2 in. in solid steel. The distance between the center of the spindle and the face of the column is 12 1/2 in. The machine is, therefore, rated at 24-in. swing. Supporting brackets are provided under the center and ends of the table. The column and table are heavily ribbed, the table having a three-point bearing in the column.

This multiple drill press is said to have great power, stiffness and rigidity and is one of the many types of heavy duty drills built by the Colburn Machine Tool Plant of the Consolidated Machine Tool Corporation of America. The main offices of this company are in New York City.

P & A Photo

Derailment at Suterville, Pa., on October 23

GENERAL NEWS

The Illinois Central has announced that all shop employees who lost their pension rights as a result of a strike in 1911, but who remained at their posts during the strike last summer, will have their lost pension rights restored.

The American Railway Association is to hold a special session at the Blackstone, Chicago, on Wednesday, December 6, to consider rules relative to distribution of freight cars and methods of securing observance of car service rules.

The Delaware, Lackawanna & Western has reached an agreement as to wages and working conditions with all its mechanical department employees, represented by a new association known as the Lackawanna Association of Mechanics, Helpers and Coach Cleaners.

The Eastern Railroad Association announces that James T. Wallis, chief of motive power of the Pennsylvania, has been elected president of the Association, in the place of A. W. Gibbs, deceased. John M. Henry, Long Island Railroad, has been elected a member of the executive committee. The office of the Association is at 614 F street, Washington, D. C.

Five hundred dollars fine and three months' imprisonment were imposed as penalties for contempt of court, in the Federal Court at Macon, Ga., on October 28, against two striking shopmen of the Central of Georgia who had violated the injunction against interfering with railroad employees. The two men were found guilty of attacking two workmen several weeks ago. A third man who was tried was found by the jury not guilty.

One of the six new superheated locomotives which have been put into operation on the Glasgow & South Western Railway (Scotland) during a trial run between Glasgow and Carlisle, attained a speed of 69 miles an hour with a load of 325 tons. The normal maximum load for a single engine on the section at which this speed was attained is 240 tons. The locomotives are of the Baltic or 4-6-4 type, and are 47-ft. 7-in. in length, with a weight of 99 tons.

The riding characteristics of one of the Baldwin-Westinghouse electric locomotives used on the Chicago, Milwaukee & St. Paul have been improved by dividing the cab in two parts, according to a report called the "Log of the Manhattan" issued by the Baldwin Locomotive Company which describes a trip made through the west by President Vauclain and party. The report states: "Engines 10306 and 10307 took the curves easily and rode well. It is only in comparison with engine 10301 that they suffer, because engine 10301 seems to leave nothing to be desired." The last mentioned locomotive has a divided cab, while the other two have not.

Railroads in Wisconsin Ordered to Repair Cars

Railroads operating in Wisconsin were ordered last week by the railroad commission of that state to take immediate steps to relieve the freight car shortage situation by repairing the cars now idle because of unfitness for service. The roads are called on to make daily reports on the results of their car repair work.

Cab Signals on the Northern of France

The Northern Railway of France, as is well known, has used an audible cab signal for 40 years or more, the simple contact apparatus known as the "crocodile." From an inquiry which has been made in connection with the action of the French Government in calling upon all the railroads of the Republic to adopt some kind of cab signal it appears that the Northern now has in service 2,906 locomotives of which all but 43 have the cab signals. These 43 are at present in the shops. Of the engines fitted, 752 are in the passenger service, 1,726 in freight service and 385 are switching locomotives.

English Firm to Build 17 Locomotives for Spain

Messrs. Babcock & Wilcox, a British concern, have received an order from the Northern Railway of Spain for 17 locomotives. These locomotives will be built at the company's Spanish works at Galindo, near Bilbao. These locomotives will be the most powerful in use in Spain, according to the Times (London) Trade Supplement.

Tennessee Central Shops Destroyed by Fire

The machine, blacksmith, tin and woodworking shops of the Tennessee Central at Nashville, Tenn., were destroyed by fire on October 27, with an estimated loss of $80,000. Six freight cars were also burned and four locomotives damaged. The company intends to replace immediately both the shop buildings and the machinery which was destroyed within.

Tank Car Safety Valves

The Mechanical Division of the American Railway Association has issued a circular granting permission to companies having stocks of tank car safety valves of the 1920 design to place in service prior to July 1, 1923, any valves now on hand of that design. All patterns should be changed at once so that future castings will comply with the requirements shown in Supplement 1 to the Tank Car Specifications for 1920, Fig. 9-A and 10-A.

Air Brake Association Proceedings

The printed proceedings of the 29th annual convention of the Air Brake Association will be issued later this year than usual, according to advice from Secretary F. M. Nellis. There are two reasons for the delay: First, the postponement of the convention from its usual time early in May to the latter part of June. Second, the shopmen's strike, during which air brake men were pressed into extra duties, making it impossible for them to find time to correct and return their remarks to the secretary. However, the book is now on the press and should be ready for distribution about December 15.

British Concern to Build Locomotives in India

A group of influential Indian gentlemen, early in the year 1921, invited Kerr, Stuart & Company, Ltd., of Stoke-on-Trent, England, to form a company in India for the purpose of building railway locomotives. In their annual report submitted to the shareholders, the directors of the company state that they have decided to accept this invitation after having fully considered and investigated the proposition. An undertaking known as the Peninsular Locomotive Company has been formed, the capital having been subscribed privately in India. The production of locomotives on an extensive scale is expected to begin shortly.

A Love-Feast

The shopmen of the Central of Georgia at Macon, Ga., several hundred of them, entertained the Rotary Club of Macon, and other friends, at luncheon in the mammoth machine shop; 92 Rotarians and 60 other guests. The tables were decorated with chrysanthemums and the colors of the Rotary Club. A number of officers of the railroad were present, and one of them, John D. McCartney, assistant to the president, acted as spokesman for the hosts. Following the luncheon, the visitors in-

spected the shops. This luncheon appears to have been given in recognition of the friendly relations existing between the railroad and the people of the city during the recent disturbances due to the strike.

Brotherhoods Oppose Changes in Working Conditions

A controversy, which labor leaders claim represents the inauguration of an attack on the eight-hour day, came before the Railroad Labor Board on November 2 when W. G. Bierd, receiver of the Chicago & Alton and other officers of that road appeared before the board in support of a petition asking for the elimination of time and one-half for overtime in road-freight transfer and hostler service, the extension of the present eight-hour rule to nine hours in short turn-around passenger service and a modification of the working schedules in outlying switching yards on the road.

Operating Statistics for August and Eight Months

The net ton miles of revenue and non-revenue freight handled by the railroads in the month of August totaled 30,452,000,000 as compared with 30,420,000,000 in August, 1921, according to the monthly bulletin of operating statistics issued by the Interstate Commerce Commission. The car miles per car day averaged 21.8 as compared with 22.7 last year, the net tons per loaded car 26.3 as compared with 27.4 and the net ton miles per car day 406 as compared with 400. For the eight months ended with August, the net ton miles totaled 227,739,000,000 as compared with 222,411,000,000 last year.

P. R. R. Improvements at Pitcairn

The Pennsylvania has just completed and placed in service at Pitcairn, Pa., a modern 34-stall enginehouse with turntable at a cost of $1,385,000. This terminal is located on the main line of the Central Region and is one of the key positions of the system in expediting the movement of through trains. Nearly 200 engines are handled daily. In addition to preparing the engines for service the heaviest of running repairs will be made at Pitcairn. Among the important facilities at the new enginehouse is the turntable, 110 ft. long and electrically operated. Each stall is 140 ft. long and so constructed that it can be completely enclosed. The structure is steam heated.

Cab Signals on the Orleans Railway

The Orleans Railway of France, operating 2,969 locomotives, now has 547 of these equipped with apparatus for giving an audible signal in the cab. This system is of the ramp type and "crocodiles" (ramps) have been installed at 987 distant signals. By the end of this year the total number of locomotives equipped will be increased to 802. The Orleans is the railroad which for years has had torpedo machines in service at home signals—apparently throughout the whole of its more important lines—and concerning which an officer of the company has said that not for 50 years have trains been in serious collision because of an engineman overrunning a fixed stop signal.

Air Brake Hearings Resumed

Hearings before Examiner Mullen of the Interstate Commerce Commission in connection with the commission's general air brake investigation were resumed at Washington on Wednesday, November 8. Witnesses representing the Automatic Straight Air Brake Company presented a number of voluminous exhibits covering air brake failures and the results of tests and were to be recalled later for cross-examination after the representatives of the roads had had an opportunity to check them. The first witness was a conductor for the Virginian who filed records of several hundred air brake failures on the Virginian and other roads. On being questioned as to whether he was able to testify to these records from his personal knowledge he said that about 75 of the failures occurred on his own train and that these cases had been checked in his exhibit and that the others could be identified by the notation "B. S." which he had used to indicate that the information was taken from the records of the Bureau of Statistics.

Striking Shopmen Reopen Relations with the Labor Board

The first move to re-establish relations between the Railroad Labor Board and the Railway Employees' Department of the American Federation of Labor was made on October 21 when B. M. Jewell, leader of the shopmen's strike, called upon Chairman B. W. Hooper of the Board and gave notice that the shop crafts would present a petition for the reopening of a case against the New York Central, involving the question of the piece work system in the Elkhart (Ind.) shops. It was unofficially intimated at the board that Mr. Jewell's petition would be granted and that the Labor Board would resume its status as umpire in disputes affecting this organization and those roads on which it still retains a majority of the shop workers.

State Statute Regulating Car Repair Shops

The federal district court of the District of Minnesota, Third Division, holds that the requirement of the Minnesota statute of 1919, as amended 1921, c. 481, requiring buildings for the construction or repair of railroad cars, is in conflict with section 4 of the Safety Appliance Act, requiring defective cars on interstate carriers' lines to be repaired at the place where the defect is discovered, if feasible, or at the nearest available repair point, and, the federal statute being paramount, the state statute is void as to this requirement.

The whole statute was held void because the section providing for the protection of employees from working outside in inclement weather is too uncertain and indefinite to be valid, this section embodying the real ground of the statute.—C. & N. W. v. Railroad & Warehouse Commission of Minnesota, 280 Fed. 387.

Hungary Builds Locomotives with Water Tube Fireboxes

The Hungarian State Railways, with a view to testing the relative merits of the 4-6-0 type of passenger engine arranged for simple and compound operation, in both cases with superheated steam, have built one of each type at the shops at Budapest, and some extensive tests have been made. These tests favored the single-expansion type of locomotive and large orders for this class of locomotive are now in course of execution. The engines are fitted with water tube fireboxes, feed water heaters with purifiers and other special features. For freight traffic locomotives of the 2-8-2 and Mallet types have been introduced and both these are similarly equipped with water tube fireboxes and the other devices mentioned. The locomotives are of large proportions and designed for the highest tractive effort that circumstances permit. The difficulty in Hungary is that maximum axle loads of 14 tons cannot be exceeded in the eastern zone and 16 tons per axle in most of the other districts. These moderate loadings have naturally had their effect upon locomotive design, the weight having to be distributed over a greater number of wheels than would otherwise have been necessary.

Katy Employees Organize Union

Employees in the motive power and car departments of the Missouri, Kansas & Texas lines have completed the organization of the M. K. & T. Association of Metal Craft and Car Department Employees, "to promote the welfare and protect the interests of its members, to promote good feeling and constructive co-operation between the members and the officers of the railway, and, by joint action, protect and promote the interest of the public." The organization was completed at a meeting held recently in Parsons, Kan., attended by seventy delegates, representing employees at practically all terminal and shop points on the system.

A system adjustment board was created under the provisions of the Transportation Act, and the by-laws of the association provide that this board shall act as the official representative of the association. It is the duty of the adjustment board to place before the officers of the railway all matters submitted to it by local adjustment boards, concerning grievances and it will deal with all matters relating to interpretations of rules, rates of pay and working conditions.

The by-laws further provide that any disputes which cannot be settled in conference between the system adjustment board and officers of the railway, shall then be handled in accordance with the provisions of the Transportation Act.

New Freight Cars for the Southern Pacific

The immediate construction of 7,000 freight cars, to cost more than $8,000,000, has just been authorized by the executive committee of the Southern Pacific Company. This new equipment, which will be delivered during 1923, does not include refrigerator cars for handling perishables, as the company's supply of refrigerators is provided by the Pacific Fruit Express Company, in which the Southern Pacific owns a one-half interest. The new equipment program of the Pacific Fruit Express, soon to be announced, will add a substantial number of refrigerators to the 21,598 it now owns. Plans for the construction of the new cars for the Southern Pacific are nearing completion and it is expected that a large proportion of the cars will be built on the Pacific Coast with Pacific Coast materials and labor. The new cars will be of the most modern design. The total number of cars owned by the Southern Pacific Company at present is more than 58,000.

4-6-4 Type Tank Locomotives for Java

The Dutch Colonial Government Railway of Java, which is of 3 ft. 6 in. gage, has received some new tank locomotives of the 4-6-4 type from Sir W. C. Armstrong Whitworth & Co., England. These locomotives are capable of exerting a tractive force of 19,300 lb. at 85 per cent of the boiler pressure and weigh 147,840 lb. in working order, of which 72,800 lb. are on the drivers. The cylinders are 17¾ in. by 21⅝ in., driving wheels 53⅛ in., driving wheel base 9 ft. 10 in., and total wheel base 32 ft. 7¾ in. The boiler is of the straight top type with a maximum internal diameter of 4 ft. 7¼ in. and carries 176 lb. pressure. The firebox is of copper and the superheater of the Schmidt type. The tubes and flues contain 996.4 sq. ft. of heating surface, the firebox 83 sq. ft. and the superheater elements 332 sq. ft. The grate area is 20 sq. ft. Grate bars are arranged to be spaced for India coal, Australian coal or wood fuel. The cylinders are outside of the frames and the valve motion is of the Walschaert type, operating 8½-in. piston valves. The engine is fitted with vacuum, steam and hand brakes. The coal capacity is 3 tons while the water tanks hold 2,000 gallons.

Great Western to Increase Number of Motor Car Trains

The Chicago Great Western considers its recent experiment in gasoline motor driven cars for passenger service on branch lines such a success that it is planning to purchase several additional motor trains mainly for service in the more thickly settled sections of Iowa. The trains consist of a specially constructed motor car, equipped with a high-power gasoline engine and a trailer which resembles an ordinary interurban electric coach, although more heavily built. The motor car has room for freight and baggage just back of the compartment occupied by the engineer.

"My theory is," S. M. Felton, president, is quoted as saying, "that with the low overhead on the gasoline-driven train, we can afford to stop at every crossing, farmhouse or small station, if necessary. In this way we expect to give the kind of service which will be appreciated by the Iowa farmers and build up a good interurban traffic. The interurban trolley systems can do this and make it pay and so should the railroads. We have the tracks, the stations, and all the other equipment of a right-of-way. All that is necessary is to add the trains."

The four trains now in use in Iowa, Mr. Felton added, are running from 100 to 150 miles a day without difficulty. The Russell Company, Kenosha, Wis., supplied the equipment recently placed into service by this company between Des Moines, Ia., and Marshalltown.

Only Four Wooden Mail Cars

The wooden railroad car is almost gone, says a statement issued by the Post Office Department. "It is about ready to fade into the past, joining the passenger pigeons, the wild west, the horse drawn carriage and ginger-bread houses." According to the figures of the Post Office Department there are only four wood mail cars now in use out of about 5,000 cars formerly employed to transport United States mail. In 1913 a law was passed by Congress, later re-enforced by a law passed in 1916 requiring that no more mail cars be admitted for postal service unless they were all steel or steel under-frame. Those wooden cars which were in use were allowed to remain in service. With the gradual replacement of wooden cars with steel, injuries and deaths of post office employees are said to have greatly decreased. During the last year only two clerks were killed in accidents and 26 seriously hurt. Almost 20,000 railway postal clerks now are employed in the railway mail service.

Later, in order to correct any false impression which might be gained from the statement to the effect that there were only "four wood mail cars now in use," the department issued a statement giving the following statistics on the kinds of cars used in the service. Of the 1,087 Railway Post Office cars 862 are all steel, 154 are steel underframe, 67 are wood steel reinforced, and four are all wood construction. Of the 4,074 apartment cars in use 1,104 are all steel, 641 are steel underframe, 1,947 are wood, steel reinforced, and 382 are all wood construction.

Labor Board Decisions

NO AUTHORITY OVER LINES OUTSIDE OF U. S.—In a case concerning track forces on the Great Northern lines in Canada, the Labor Board held that it had no authority over the rates of pay and working conditions for employees engaged exclusively in work outside the territorial limits of the United States.—(*Decision No.* 977.)

CONTRACTING COAL AND WATER SUPPLY WORK.—The Chicago & Alton awarded a contract to Joseph Colianni & Brothers for the handling of coal, sand and cinders, the pumping of water and for engine watchmen, the employees of the railroad having the privilege of going to work for the contractors at a reduced rate of pay. This was brought to the attention of the Labor Board which decided that this case involved the same principles that applied in the case of the Indiana Harbor Belt, that the contract constituted a violation of the Transportation Act, in so far as it purported to remove the employees from the application of the act; and directed the carrier to take up with any employee the matter of reinstatement upon the application of the employee or his representative.—(*Decision No.* 1254.)

In 1921 the St. Louis-San Francisco advertised for bids for the personal labor required for the operation of individual water stations on a monthly basis. This case (No. 1230) the Labor Board decided substantially the same as that of the C. & A.

DISMISSAL OF BRIDGE EMPLOYEES FOR REFUSAL TO WORK OVERTIME.—About 7:15 p. m., on July 29, 1921, 645 ft. of double track trestle on the Stockton division of the Southern Pacific near Banta, Cal., was discovered on fire and 135 ft. was destroyed before the fire was extinguished. It was necessary to call men from adjoining divisions to restore the trestle and track as promptly as possible. Foremen and men were brought from the Sacramento division, arriving at nine the next morning. These men worked until 4 p. m., when they returned to their outfit cars and refused to perform further service at the pro rata rate, notwithstanding that an emergency existed; and for this action they were discharged. In a decision upon a protest registered by the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers the Labor Board decided that the management was justified in the action taken in this case and denied the request of the employees' organization for the reinstatement of the men.—(*Decision No.* 1118.)

The New Santa Fe Shop Employees' Association

Our attention has been called to the fact that the article appearing in the November *Railway Mechanical Engineer*, Page 667, omits the Atchison, Topeka & Santa Fe as one of the first railroads on which associations of shop employees were formed independent of the American Federation of Labor. The list of roads named at that time emanated from the Railroad Labor Board, as stated, but unfortunately the Santa Fe was not included in the board's announcement.

When the strike began, 2,300 mechanics remained in the service of the Santa Fe. and by August 22, the number of employees in the mechanical department had reached a total of 13,702 or 71 per cent of the normal force. These employees had already formed company unions among themselves and had made a request on the management to negotiate new agreements. Consequently on August 22 new agreements were signed with the shop craft associations; *i. e.*, machinists, boilermakers, blacksmith, sheet metal workers, electricians, and carmen and their helpers and appren-

tices. Agreements were also made with the stationary engineers, firemen and oilers. The date of this action, therefore, places the Santa Fe as one of the first railroads in the country to reach a satisfactory settlement of the strike. On October 19, the force in the mechanical department had reached 100 per cent, the road having at the present time 18,972 employees in the mechanical department.

In discussing the effect of the strike on the Santa Fe, one of the officers of that road recently said, "Never in the history of the Santa Fe System Lines has it been offered and handled as heavy a business as it has since the latter part of August. We have no embargoes in effect; we have no serious congestion of any kind; our condition of motive power is normal. Our bad-order freight car situation, as of October 25, showed only 4.69 per cent of all cars on our lines in need of repairs, the lowest point of record since the return of the roads to private control. We have 2,000 new box cars soon to reach us and we have ordered for delivery in the first quarter of next year 59 locomotives, 1,000 box cars, 1,000 automobile cars, 2,000 refrigerator cars, 500 double-deck stock cars and 500 coal cars."

Coal Analyses by Bureau of Mines

The results of analyses of hundreds of coals from 25 States and the territory of Alaska are given in Bulletin 193, "Analyses of mine and car samples of coal collected in the fiscal years 1916 to 1919," by Arno C. Fieldner, Walter A. Selvig, and J. W. Paul, just issued by the United States Bureau of Mines. Information as to the heating values of all coals tested is also given in the bulletin, which should be of interest to all extensive users of coal fuel.

Many mine samples of coal are analyzed each year in the laboratories of the Bureau of Mines. Descriptions of the coal samples collected between the beginning of this work, July 1, 1904, were compiled and published in Bureau of Mines Bulletins 22, 85 and 123.

In order that the material in this bulletin may be used to supplement that presented in earlier bulletins, the same plan of geological classification has been followed, the analyses and descriptions of the samples being grouped in alphabetical order according to the state, county and town near which the mines or prospects sampled are situated.

Information regarding coal sampling and analytical methods employed by the Bureau of Mines and a bibliography on the coal resources of the world are contained in the bulletin.

The entire distribution of Bulletin 193 will be through the superintendent of documents, Government Printing Office, Washington, D. C., from whom the report may be obtained at a price of 35 cents. Bulletin 22, 85 and 123 are sold by the superintendent of documents at prices of 85, 45 and 50 cents, respectively.

Electrification of the South Eastern & Chatham Railway, England

Plans and negotiations are being made for the purpose of obtaining a supply of electric power for the electrification of the South Eastern & Chatham. The railroad company has applied to the Electricity Commissioners for consent to the establishment of a 60,000-k.w. generating plant at Angerstein's Wharf, Charlton. The West Kent Electric Company, Limited, also applied for consent to build a 150,000-k.w. generating station at Belvedere in the urban district of Erith. During the course of the inquiry, offers to supply the railroad company were made by the West Kent Company and by the County of London Electric Supply Company.

An important factor in this case is the forthcoming grouping into one railway system of the London & South Western, the London, Brighton & South Coast and the South Eastern & Chatham Railways. The London & South Western Railway Company is supplied with electric power from its 25-cycle generating station at Wimbledon. The London, Brighton & South Coast purchases energy from the London Electric Supply Corporation. The further electrification of that railway's suburban lines will entail a supply which will be many times in excess of that now furnished by the London Electric Supply Corporation and this additional supply must be supplied at a frequency of 25 cycles, for the reason that the equipment of the company's rolling stock is designed for that frequency. The South Eastern & Chatham Railway Company also desire a supply at 25 cycles, but as their system of electrification will be direct current, a supply at a frequency of 50 cycles is also practicable.

It is expected that the first stages of the electrification of the South Eastern & Chatham will be completed by June 30, 1925, and arrangements have been made with the Treasury for a guaranteed loan of £6,500,000, five millions of which are to be expended on the electrification of the lines. This financial assistance is dependent upon making arrangements for an adequate power supply. If the railway company purchases its power supply from an outside source, it will be relieved from a capital outlay of something more than £1,000,000.

Mechanical Convention in 1923

The General Committee of the Mechanical Division of the American Railway Association decided at a meeting held in New York on November 8 not to hold in 1923 a convention of the kind ordinarily held in past years. It was decided to hold merely a business session of the Mechanical Section, at which reports dealing with interchange of cars, standard box cars and kindred matters will be received.

The explanation given for this action is that owing to the shop employees' strike no meetings of the committees of the section have been held to consider most of the regular reports, and that it will be impracticable to hold meetings of this kind during the rest of the present year. It was therefore decided that it would be impracticable to prepare the usual reports for the convention.

This decision, if left unchanged, means that the business session will be held at some place possibly Chicago, instead of the convention being held at Atlantic City, as originally intended. It also means that no exhibit of equipment and supplies will be given and that the session will last only two or three days.

MEETINGS AND CONVENTIONS

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION—F. M. Nellis, Room 3014, 165 Broadway, New York City. 1923 annual convention; Denver, first Tuesday in May.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamilton Ave., Chicago.

AMERICAN RAILWAY ASSOCIATION, DIVISION V—MECHANICAL—V. R. Hawthorne, 431 South Dearborn St., Chicago.

DIVISION V—EQUIPMENT PAINTING DIVISION.—V. R. Hawthorne, Chicago.

DIVISION V—PURCHASES OF STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—R. D. Fletcher, 1145 E. Marquette Road, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, A. F. Stuebing, 2201 Woolworth Building, New York.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—W. A. Booth, 53 Rushbrook St., Montreal, Que. Next meeting December 12. A paper on Some Recent Developments in Car Construction will be presented by E. R. Viberg, mechanical engineer, Car & Foundry Co., Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—Thomas B. Koeneke, 604 Federal Reserve Bank Building, St. Louis, Mo.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings second Thursday in January, March, May, September and November, Hotel Iroquois, Buffalo, N. Y.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—W. P. Elliott, T. R. R. A. of St. Louis, East St. Louis, Ill.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Regular meetings second Tuesday, February, May, September and November.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. G. Crawford, 702 East Fifty-first St., Chicago, Ill.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Next meeting December 12. A paper on Creosoting Treatment for Railway Ties will be presented by F. C. Shepherd, assistant chief engineer, Boston & Maine, Boston.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York N. Y. Next meeting December 12. Fiftieth anniversary dinner.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 623 Brisbane Building, Buffalo, N. Y.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Next meeting December 8. A paper on Railroad Masters will be presented by W. G. Besler, president, Central of New Jersey. Entertainment.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 605 North Michigan Ave., Chicago. Regular meetings third Monday of each month, except June, July and August.

SUPPLY TRADE NOTES

John G. Turpie has been appointed assistant to the president and B. W. Lockwood to consulting engineer of the Standard Tank Car Company, Sharon, Pa.

C. E. Naylor has been appointed Texas sales agent of the Lukens Steel Company, Coatesville, Pa. Mr. Naylor's office is at 610 Carter building, Houston, Tex.

E. A. Hurlbut, formerly western railway sales representative of the Crouse-Hinds Company, with headquarters at Chicago, died in Evanston, Ill., on October 9.

W. E. Caldwell has been appointed sales manager of the Cleveland Twist Drill Company, Cleveland, Ohio, succeeding E. G. Buckwell, retired. Harry Jenson has been appointed assistant sales manager; Robert G. Berrington, sales representative in the Philadelphia district, and George Kast, treasurer, has taken on the duties of secretary. Mr. Caldwell, who has been with the Cleveland Twist Drill Company since 1901, was appointed assistant sales manager in 1916. Mr. Jenson was for more than 15 years a representative of the company in the Philadelphia territory, and Mr. Berrington, for 13 years a representative of the sales department in the central states and Canada, has returned to the Cleveland Twist Drill Company after resigning two years ago to act as sales agent for a line of machine tools in the Cleveland territory. Mr. Buckwell, retired secretary and sales manager, previous to 1899 was a traveling salesman for the Sargent Company and later a member of the retail hardware company of McClung, Buffat & Buckwell at Knoxville, Tenn.

W. E. Caldwell

The Black & Decker Manufacturing Company, Baltimore, Md., has removed its branch office and service station from 318 North Broad street to 824 North Broad street, Philadelphia, Pa.

The Carter Bloxonend Flooring Company, Kansas City, Mo., has received a contract from the Baltimore & Ohio for the installation of 12,000 sq. ft. of bloxonend flooring in a warehouse at Philadelphia.

W. W. Sayers, representative of the Link-Belt Company, with headquarters at Chicago, has been promoted to chief engineer of the Philadelphia works and Eastern operations, with headquarters at Philadelphia.

A. H. Hunter, president of the Atlas Steel Corporation, Dunkirk, N. Y., has resigned as president, but is still a member of the board. No action has been taken as yet toward electing a successor to Mr. Hunter.

The Norwalk Iron Works Company, South Norwalk, Conn., has opened a Chicago office at 627 W. Washington boulevard in charge of L. R. Bremser, who for 13 years was associated with the Gardner Governor Company.

The Southern Dry Dock & Shipbuilding Company, Orange, Tex., has arranged for a change of name to the Orange Car & Steel Company. Its operations in the future will be concentrated on steel railroad car construction and repairs.

William Le Compte has been appointed sales manager in charge of the New York territory for Jenkins Bros., 80 White street, New York. Mr. Le Compte has been a member of the sales organization of this company for a quarter of a century.

Paul A. Cuenot has been appointed mechanical representative to furnish special tool service to customers of the Alvord Reamer & Tool Company, Millersburg, Pa. Mr. Cuenot was formerly connected with the American Locomotive Company and the Pennsylvania Steel Company.

R. J. Platt, sales representative of the Sellers Manufacturing Company, with headquarters at Chicago, has been promoted to assistant general sales agent, with office at the same place, succeeding T. D. Crowley, who has resigned to enter the service of the Creepcheck Company.

R. S. Gay, formerly Chicago sales representative of Beal Brothers and the Beal Tool Company, and more recently plant manager of Hubbard & Co., Montpelier, Ind., has been appointed a sales representative of the Safety Car Heating & Lighting Company, with headquarters at Chicago.

E. C. Wilson, formerly connected with the U. S. Light & Heat Corporation and the Vapor Car Heating Company, with offices at Chicago, has been appointed western sales manager for the Ohio Locomotive Crane Company, of Bucyrus, Ohio, with offices in the Railway Exchange building, Chicago.

G. P. Atkinson, for several years connected with the sales department of the Weston Electrical Instrument Company, Newark, N. J., has established an office at Atlanta, Ga., to represent that company in Georgia, South Carolina and northern Alabama. In addition to Weston instruments, Mr. Atkinson will represent several other electrical equipment companies.

F. F. Rohrer, assistant to manager of both the power and railway departments of the Westinghouse Electric & Manufacturing Company, has been appointed general contract manager of that company. In his new appointment, which is effective immediately, Mr. Rohrer will be a member of the staff of W. S. Rugg, general sales manager. In his new position, Mr. Rohrer assumes responsibility for service to customers under contracts and will have general supervision of all contract and order work of the company. In addition to this general work, he will continue to have direct charge of the contract work of the power and railway departments, which duties he performed in his previous position. Mr. Rohrer was born in Harrisburg, Pa., April 22, 1876, and attended school there until 1895. He entered the employ of the Westinghouse Company as a student in 1896. After serving in the shops for four years, during which time he obtained extensive training in the manufacturing and testing departments he was transferred to the sales department. His services in the latter department have included a number of positions of responsibility. During the war, Mr. Rohrer was a member of the Committee of the War Industries Board appointed to conserve the production of turbine-generating equipment for government needs. After the armistice was signed, he became the representative of the Westinghouse Company in the settlement of contracts which were terminated as a result of the ending of the war. When this work was completed, he served in the capacity of assistant to the managers of both the power and railway departments.

F. F. Rohrer

J. G. Carruthers, manager of sales in the Chicago district for the Illinois Steel Company, and special sales agent of the Carnegie Steel Company, with headquarters at Chicago, has resigned to become general sales manager of the Otis Steel Company, Cleveland, O. He will be succeeded by D. T. Buffington of the structural and plate bureau, general sales department, Illinois Steel Company.

Frederick B. Larsen is now field representative for South Carolina, Georgia and Florida for the Bryant Electric Company,

Bridgeport, Conn. Mr. Larsen's headquarters are at Atlanta, Ga. He was for three years manager of the Hunter Electric Company, of Clearwater, Fla., and prior to 1919 he was for 12 years sales representative of the Robbins & Meyers Company in the South Atlantic states.

Joseph T. Ryerson & Son Celebrates Eightieth Anniversary

One of the oldest companies in the railway supply business in this country is Joseph T. Ryerson & Son, which last month celebrated its eightieth anniversary. The history of the company and the earlier connection of the Ryerson family with the iron industry in this country are fascinating chapters in the development of industry and transportation in America.

Shortly after New Jersey was granted to Lord Berkeley, George Ryerson and a syndicate purchased 6,000 acres of land in the northern part of the state. In 1695 the development of this tract for agricultural purposes was begun. Later ore fields were discovered and developed so that Mr. Ryerson and his associates were among the first to work the iron mines in this region. His son, Marten Ryerson, further developed iron production and quite an amount of pig iron was made as early as 1740. The Ringwood and Wynokie mines in this region supplied the colonial army with great quantities of munitions material and equipment during the Revolutionary War.

About 1790 Marten's son, Thomas Ryerson, moved to Philadelphia and started business as a wholesale dealer in finished iron and steel products. Joseph, the son of Thomas Ryerson, continued in the same business. Hearing the call of the west, he started for Chicago in 1842 as the agent of Wood, Edwards & McKnight of Pittsburgh.

Some idea of the development of the country at this time can be gained from the transportation facilities. On his trip he went by railroad from Philadelphia to Columbia, Pa., then by stage coach to Pittsburgh and Cleveland; by boat to Detroit; by railroad to Jackson, Mich.; by stage to St. Joseph, Mich., and by boat to Chicago. The journey took eight days and he arrived November 1, 1842.

The rent for Mr. Ryerson's first store, near Clark and Water streets, was $200 a year. From this small beginning has developed the present company. As business expanded, Mr. Ryerson moved first to Lake street and then to South Water street, where the warehouse was located for many years.

Joseph T. Ryerson died in 1883 and his son, Edward L. Ryerson, succeeded him as the head of the business. The company was incorporated as Joseph T. Ryerson & Son in 1888. In 1908 the first buildings of the present Chicago plant were erected. They have been gradually expanded since until they now occupy over 19 acres. Other plants were established in St. Louis in 1914; in New York in 1915; in Detroit in 1917, and in Buffalo in 1919. The five plants now cover 40 acres, having a combined floor space of nearly 1,500,000 sq. ft.

Old Warehouse on South Water Street, Chicago, Occupied by Joseph T. Ryerson from 1852 to 1872

TRADE PUBLICATIONS

TAPS AND DIES.—The Tap & Die Institute, New York, has issued a 17-page catalogue which contains a few of the more important standard tables which it has prepared and adopted in an effort to obtain a greater degree of uniformity in the dimensions of taps and dies.

CENTRIFUGAL PUMPS.—The Dayton-Dowd Company, Quincy, Ill., has issued bulletin No. 249 illustrating and describing its line of centrifugal pumps.. This bulletin includes detailed specifications, efficiency and capacity tables and characteristic curves, as well as a description of the company's method of testing the pumps. The illustrations show the pumps in various combinations and installations.

DIE HEADS AND TAPPING DEVICES.—The Geometric Tool Company, New Haven, Conn., has just issued two neatly arranged, illustrated catalogues, one of which covers the Jarvis line of tapping devices, tapping machine, quick change chucks and collets, and self-opening stud setter; the other, the Geometric style DS die head as applied to Brown & Sharpe automatics and other single-spindle automatics.

LINE SHAFTING EQUIPMENT.—Catalogue No. 43, giving dimensions, details of constructions and list prices, thus enabling engineers, designers, mechanics and power users to plan installations of and purchase the line shafting equipment described, has recently been issued by the Medart Company, St. Louis, Mo. The catalogue, which contains 192 pages, supersedes all previous catalogues and publications.

EXPRESS REFRIGERATOR CARS AND TANK CARS.—The Canadian Car & Foundry Company, Ltd., Montreal, has recently issued bulletins describing steel underframe express refrigerator cars built for the Canadian Pacific and all-steel tank cars of 8,000 gallons capacity built for the Russian Soviet Government. Another bulletin describes helical, semi-elliptic, and elliptic springs manufactured by this company.

THE GAP CRANE.—The H. K. Ferguson Company, Cleveland, Ohio, has issued a four-page leaflet illustrating the adaptation of the gap crane to an erecting shop for the handling of heavy locomotive repairs as worked out for the Hornell (N. Y.) shop of the Erie now under construction. This leaflet shows the manner of handling locomotives with this crane and points out the advantage of this new equipment.

TIMBER STATEMENT.—The Century Wood Preserving Company, Pittsburgh, Pa., has published timber bulletin No. 24, which is devoted to the consideration of treated timber for flooring and pavements, poles, cross arms, fencing, bins, sheds, platforms, walks, trestles and similar industrial uses. The bulletin is well illustrated and contains data on the proper piling of ties, as well as tables showing the amount of preservatives required.

HOLT ROOF LEADER AND VENT CONNECTIONS.—This 28-page booklet recently issued by the Barrett Company, New York, is descriptive of the eight types of Holt roof connections manufactured by this company. The different types are discussed in relation to their use in flat roof and saw-tooth construction and in places where vent pipes, leader lines, steam stacks, etc., passing through a roof require flashings. The illustrations show by photographs and drawings actual installations and the way in which they are made.

SPRAY-PAINTING EQUIPMENT.—An attractive illustrated folder describing a new series of portable spray-painting equipment designed to meet large or small painting requirements, has recently been issued by the DeVilbiss Manufacturing Company, Toledo, Ohio. This folder describes the uses, advantages and economy of DeVilbiss portable equipment for spray-painting houses, building interiors and exteriors, railway equipment, bridges and all kinds of large stationary work. Typical illustrations of various portable spray-painting outfits are shown on the interior of the folder, and photographs of this equipment in actual operation are included. A condensed, yet comprehensive, description of the outfits and methods of operation is also included.

EQUIPMENT AND SHOPS

Locomotive Orders

The Pere Marquette has ordered 20 switching locomotives from the American Locomotive Company.

The Central of New Jersey has ordered 10 Mikado type locomotives from the American Locomotive Company.

The Chesapeake & Ohio has ordered 2 Mountain type and 6 Pacific type locomotives from the American Locomotive Company.

The Illinois Central has ordered 85 Mikado type locomotives from the Lima Locomotive Works. It is expected that this road will place an order soon for 40 additional locomotives.

The New York, New Haven & Hartford, reported in the November *Railway Mechanical Engineer* as having ordered 5 electric locomotives from the Westinghouse Electric & Manufacturing Company, has ordered 7 additional electric locomotives from the same company.

The Mexican Railway Company, Ltd., has ordered 10 electric locomotives. These locomotives will be constructed and equipped jointly by the General Electric Company and the American Locomotive Company. The locomotives will have a total weight in working order of 300,000 lb.

Passenger Car Orders

The Chicago & North Western has ordered 40 coaches and 10 baggage cars from the American Car & Foundry Company.

The Pennsylvania has ordered 3 gasoline motor cars from the J. G. Brill Company. These cars are for use on the Smyrna branch, Bustleton branch and the Berwick branch.

The Central of New Jersey, reported in the November *Railway Mechanical Engineer* as having placed orders for 65 cars for passenger service, has placed additional orders for 25 coaches with the American Car & Foundry Company, and 25 coaches with the Standard Steel Car Company.

Freight Car Orders

The Union Pacific has placed an order with the American Car & Foundry Company for 100 tank cars.

The Cudahy Packing Company, Chicago, will build 200 refrigerator cars in its shops at East Chicago.

The Western Pacific has ordered 100 automobile cars from the Mount Vernon Car Manufacturing Company.

The Lehigh & New England has ordered 100 gondola cars of 50 tons' capacity from the Magor Car Corporation.

The Chicago & North Western has ordered 800 steel ore cars of 50 tons' capacity from the Pullman Company.

The Old Time Molasses Company, Inc., has placed an order with the American Car & Foundry Company for 72 tank cars.

The Charleston & Western Carolina has ordered 100 single sheathed box cars of 40 tons' capacity from the Standard Tank Car Company.

The Beacon Oil Company, Boston, Mass., has ordered 50 tank cars of 8,000 gal. capacity from the American Car & Foundry Company.

The West Penn Power Company, Pittsburgh, Pa., has ordered 60 hopper cars of 55 tons capacity from the American Car & Foundry Company.

The East Jersey Railroad & Terminal Company has placed an order with the American Car & Foundry Company for 36, 50-ton tank cars of 10,000 gal. capacity.

The New Orleans Great Northern is reported to have ordered 200 flat cars from the Southern Car Company and repairs to 197 gondola cars from the same company.

The Chicago, Rock Island & Pacific has ordered 500 box cars from the Western Steel Car & Foundry Company and 500 gondolas from the American Car & Foundry Company.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 500 box cars and 250 gondola cars from the Pullman Company and 500 box cars from the American Car & Foundry Co.

The Louisville & Nashville has ordered 2,100 hopper cars from the American Car & Foundry Company and has ordered 500 box cars each from the Chickasaw Shipbuilding Company and the Mt. Vernon Car Manufacturing Company.

Machinery and Tools

The Gulf & Ship Island has ordered from the Niles-Bement-Pond Company a 5-ton, 72-ft. span overhead crane.

The Chicago, Rock Island & Pacific has placed an order with the Whiting Corporation for a 200-ton transfer table.

The Lake Erie & Western has placed an order with the Shepard Electric Crane & Hoist Company for a 1¼-ton hoist.

The Baldwin Locomotive Works has ordered one 130-in. by 84-in. by 20-ft. planer from the Niles-Bement-Pond Company.

The Crucible Steel Company has ordered from Joseph T. Ryerson & Son an equipment for the repairing of locomotive boiler tubes, to be installed at its shops at Harrison, N. J.

Shops and Terminals

St. Louis-San Francisco.—This company will construct a storeroom at Ft. Smith, Ark.

Gulf Coast Lines.—This company will construct a six-stall concrete roundhouse at Brownsville, Tex., to cost approximately $50,000.

Tennessee Central.—This company will replace the machine shop, blacksmith shop, tin shop and woodworking plant at Nashville, Tenn., destroyed by fire on October 27.

Chicago, Rock Island & Pacific.—This company has awarded a contract to the International Filter Company, Chicago, for the construction of a water treating plant at Peoria, Ill.

Chicago, Rock Island & Pacific.—This company has awarded a contract to the Railroad Water & Coal Handling Company, Chicago, for the construction of a water treating plant of 25,000 gallons' capacity at Manly, Iowa.

Chicago, Burlington & Quincy.—This company has awarded a contract to Edgar Otto, Downers Grove, Ill., for the installation of a pumping plant, intake well, suction piping and intake piping for a reservoir at Galesburg, Ill.

Bangor & Aroostook.—This company has awarded a contract to the Howlett Construction Company, Moline, Ill., for a coaling station with 50 tons' ground storage and a 25 tons' overhead storage, using automatic machinery, at Squa Pan, Me.

Missouri Pacific.—This company has awarded a contract to the Ogle Construction Company, Chicago, for the construction of a 300-ton reinforced concrete coaling station at Bald Knob, Ark.; and to T. S. Leake & Co., Chicago, for the construction of a frame enginehouse 90 by 200 ft. with a composition roof at Pueblo, Cal.

Pennsylvania.—This company has awarded a contract to W. E. Wood, Detroit, Mich., for the construction of a frame enginehouse 60 by 120 ft. at Lincoln Park. The principal enginehouse, which will serve both passenger and freight locomotives, will be built by the Pere Marquette for the Pennsylvania at Nineteenth street and will cost approximately $1,000,000, including a turntable, water tank, coaling station and other buildings. A contract has also been awarded to the McClintic-Marshall Company for extensive additions to the shops at Juniata, Pa.

Improvements and extensions to cost $900,000 have been undertaken at its Enola Yard on its low grade freight line three miles west of Harrisburg, Pa. The work includes the erection of a new steel freight car repair shop, 100 ft. by 620 ft., the building of which has already been begun.

A modern 34-stall enginehouse with turntable has just been completed and placed in service at Pitcairn, Pa., at a cost of $1,385,000. The turntable is 110 ft. long and electrically operated. Each stall is 140 ft. long and so constructed that it can be completely enclosed. The building is steam heated.

PERSONAL MENTION

GENERAL

ALONZO G. TRUMBULL has been appointed chief mechanical engineer of the Erie.

W. B. WHITSITT has been appointed assistant mechanical engineer of the Baltimore & Ohio and W. R. Hedeman has been appointed chief draughtsman.

F. A. TORREY, general superintendent of motive power of the Chicago, Burlington & Quincy, with headquarters at Chicago, whose retirement was reported in the November issue of the *Railway Mechanical Engineer*, was born in Pennsylvania and when a boy served an apprenticeship in a machine shop. He entered railway service as a locomotive fireman on the Chicago, Burlington & Quincy at West Burlington, Ia., in March, 1874, and, until February 1, 1887, was a hostler and again a locomotive fireman and later a locomotive engineer. On the latter date he was promoted to road foreman of locomotives on the Ottumwa and Creston divisions, which position he held until April 1, 1889, when he was promoted to master mechanic, with headquarters at Ottumwa, Ia. He was transferred to Creston, Ia., on March 1, 1902, and on September 1, 1903, he was promoted to assistant superintendent of motive power, with headquarters at Chicago, which position he held until April 20, 1905, when he was promoted to superintendent of motive power, with the same headquarters. On January 1, 1911, he was promoted to general superintendent of motive power, with the same headquarters, from which position he retired on November 1 after 48 years of active service with the company.

J. E. O'BRIEN has been appointed manager of the mechanical department of the Seaboard Air Line, effective November 15. Mr. O'Brien will report to the president and to the vice-president and general manager. Mr. O'Brien was born on December 4, 1876, at Stillwater, Minn., and was graduated from the University of Minnesota in 1898, in which year he entered railway service as a special apprentice on the Northern Pacific at Livingston, Mont. From November 1, 1901, to November 25, 1903, he was in charge of general inspection of material and tests for that company at St. Paul, Minn. On the latter date he became master mechanic of the Dakota division at Jamestown, N. D. From December 1, 1904, to August 1, 1909, he was assistant shop superintendent at South Tacoma, Wash. On the latter date he was promoted to mechanical engineer, with headquarters at St. Paul. On January 1, 1910, he left the Northern Pacific to become superintendent of motive power of the Western Pacific, with headquarters at San Francisco. In 1913 he left this position to become assistant superintendent of motive power of the Missouri Pacific and a short time thereafter was promoted to superintendent of motive power, which position he resigned in the early part of 1922.

J. E. O'Brien

E. W. SMITH, whose promotion to general superintendent of motive power of the Southwestern region of the Pennsylvania, with headquarters at St. Louis, Mo., as reported in the November *Railway Mechanical Engineer*, was born on September 21, 1885, at Clarksburg, W. Va. He was graduated from the Virginia Polytechnic Institute at Blacksburg, Va., in 1905 and entered railway service as a shop hand in the Wilmington shop of the Pennsylvania on June 5, of that year. On August 1, 1906, he was promoted to special apprentice in the Altoona machine shop. On July 26, 1909, he was promoted to inspector in the office of the assistant to the general manager and on March 12, 1913, to foreman in the office of the general superintendent of motive power. On October 15, 1913, he was promoted to assistant master mechanic at the Wilmington shop, which position he held until April 19, 1915, when he was transferred to the Altoona machine shop. He was promoted to assistant engineer of motive power in the office of the general superintendent of motive power on July 1, 1916, and to master mechanic of the Harrisburg shops on the Philadelphia division on October 10, 1917. On May 26, 1918, he was promoted to superintendent of motive power of the Central Pennsylvania grand division, with headquarters at Harrisburg, Pa., which position he held until December 1, 1919, when he was transferred to the Eastern Pennsylvania grand division, with headquarters at Altoona, Pa. On March 1, 1920, he was promoted to engineer of transportation in the office of the vice-president in charge of operation, which position he was holding at the time of his recent promotion.

MASTER MECHANICS AND ROAD FOREMEN

J. A. BUECHLER has been appointed master mechanic of the Port Huron & Detroit with headquarters at Bay City, Mich.

D. L. RINGER, general foreman of the Texas & Pacific at Baird, Tex., has been appointed assistant master mechanic of the Fort Worth division, with headquarters at Marshall, Tex., succeeding J. E. Friend.

W. J. O'BRIEN, master mechanic of the Kanawha & Michigan, with headquarters at Middleport, Ohio, has been appointed master mechanic of the Toledo & Ohio Central, with headquarters at Bucyrus, Ohio, succeeding C. Bowersox, who has resigned to engage in other business.

JAMES E. FRIEND, assistant master mechanic of the Texas & Pacific at Marshall, Tex., has been appointed master mechanic of the Louisiana division with headquarters at Alexandria, Va. Mr. Friend was born on July 9, 1890, at Rawlins, Wyo., and was educated in the public and high schools of that town. In June, 1906, he entered the employ of the Union Pacific at Rawlins as a messenger, subsequently becoming call boy, engine dispatcher, machinist apprentice and machinist. He then served as a machinist on various roads in the northwest. From March, 1912, to June, 1915, he was a machinist on the Texas & Pacific at Texarkana, Tex., being promoted in June, 1915, to general foreman. From July, 1916, to November, 1916, he was roundhouse foreman at Big Spring, Tex.; from November, 1916, to March, 1917, general foreman at El Paso; from March, 1917, to August, 1917, general foreman at Toyah, Tex., and from August, 1917, to May, 1918, general foreman at Baird, Tex. From May, 1918, to July, 1919, Mr. Friend was a first lieutenant serving with the 50th Engineers in France as erecting shop foreman at Nevers; road foreman of engines, Base 6, Marseilles, and general road foreman of engines, Le Mans. Returning to the United States in July, 1919, he re-entered the employ of the Texas & Pacific as general foreman at Baird, being transferred in December, 1919, to El Paso. From November, 1921, to January, 1922, he was general foreman of the Los Angeles & Salt Lake at Milford, Utah.

SHOP AND ENGINEHOUSE

JOHN LOVE has been appointed general foreman of the Central of New Jersey shops at Maunch Chunk, Pa.

A. W. KOVAK, district boiler inspector of the Chicago, Milwaukee & St. Paul, with headquarters at Minneapolis, Minn., has been promoted to general boiler inspector, succeeding E. W. Young, assigned to other duties.

PURCHASING AND STORES

WINFIELD S. HAINES, assistant to the vice-president of the Erie, has been appointed superintendent of reclamation service.

J. E. TOMS has been appointed purchasing agent of the Tennessee Central, with headquarters at Nashville, Tenn., succeeding E. H. Gaines.

J. L. HIGGINS has been appointed purchasing agent and C. F. Leatherman storekeeper of the Kansas, Oklahoma & Gulf, both with headquarters at Muskogee, Okla.

J. D. MCCARTHY, purchasing agent of the Minneapolis & St. Louis with headquarters at Minneapolis, Minn., has been promoted to general purchasing agent in charge of purchases and stores of the Minneapolis & St. Louis, the Railway Transfer Company of the City of Minneapolis and the Hocking Coal Company.